





Ohio State Academy of Science
SPECIAL PAPERS, No. 5

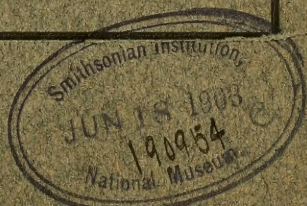
Tabanidae of Ohio

WITH A CATALOGUE AND BIBLIO-
GRAPHY OF THE SPECIES FROM
AMERICA NORTH OF MEXICO

JAMES S. HINE,
Ohio State University

===== COLUMBUS, OHIO =====

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Date of Publication, May 1st, 1903

Publication Committee:

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L. H. McFADDEN,

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COLUMBUS :
PRESS OF SPAHR & GLENN
1903



NOTE.

The results presented in this paper are based on a part of the observations and extensive collections made under two grants of fifty dollars each from the Emerson McMillin Research Fund, and some of the expense of publication is also met by a further contribution from the same fund.

WM. R. LAZENBY,

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TABANIDAE OF OHIO.

WITH A CATALOGUE AND BIBLIOGRAPHY OF THE SPECIES
FROM AMERICA, NORTH OF MEXICO.

INTRODUCTION.

With Osten Sacken's admirable "Prodrome of a Monograph of the Tabanidæ of the United States," most of the species of the family from the eastern part of our country may be identified readily. And with Williston's paper in the tenth volume of the Kansas Academy of Sciences most of our species not included in the above contribution are fully characterized. Hart's paper in the fourth volume of the Bulletin of the Illinois State Laboratory of Natural History is also useful in separating the various stages of the genera *Tabanus* and *Chrysops*, and is an important contribution to the life histories of a number of species of these two genera. The economic position occupied by the family is admirably treated in Osborn's paper on "Insects Affecting Domestic Animals," in Bulletin number five, new series, of the United States Division of Entomology. Other important contributions have appeared from time to time, but a thorough acquaintance with all this literature will not always give the student of the group the information he desires regarding points which come up in connection with many of the species of our fauna.

It is my intention in this paper to give some of the results of observations on habits taken during a somewhat extended study of members of the family, and follow with a systematic treatise of the forms known to occur within the bounds of the state of Ohio. At some future time, when the necessary material has accumulated it is the intention to give a full treatise of all the forms known to occur in North America.

The following have aided me up to the present time, in submitting material for study:

The United States National Museum; The Museum of Comparative Zoology; F. L. Harvey; Charles Dury; H. A. Gossard; C. P. Whitney; E. D. Ball; E. B. Williamson; J. C. Bridwell; Miss S. E. Harris; Chas. W. Johnson; C. C. Deam; Iowa State College; C. S. Brimley; R. C. Osburn; R. V. Harvey; E. J. Oslar; F. F. Crevecoeur; Carnegie Museum; University of Kansas; H. S. Parish; R. E. Kunzé; J. T. Lloyd; Franklin Sherman, Jr.; Charles Fuchs; Mrs. Anna T. Slossen.

I desire to study material from all parts of North America and offer to name specimens for anyone who will send them in; asking nothing for the naming except such specimens as the sender himself is pleased to donate.

It is the desire to make this paper plain enough to be easily understood, but the student must understand that it is necessary to have perfect specimens in order to be sure of his results in all cases. Many of the characters used in determining species in this family are easily damaged, consequently in collecting and pinning great care should be exercised.

EGGS AND EGG-LAYING.

All the species of the family I have observed ovipositing, place their eggs on some object that projects from and overhangs the water or that stands in wet and marshy places.

All of the Chrysops whose egg laying habits I know and many species of Tabanus place their eggs over water while other species of Tabanus oviposit on plants standing in wet ground. Some species are very precise in placing their eggs. Thus *T. stygius*, which is a very common species at Sandusky, follows the interesting habit of ovipositing on the upper surface of the leaves of *Sagittaria* just above the point where the petiole meets the expanded part of the leaf.

So closely is this habit followed that a hundred masses of eggs are found thus located to one placed otherwise. A few masses were observed on *Nymphae* leaves but located exactly as when placed on *Sagittaria*. Only a very few masses were observed not placed in exactly the same position in reference to the leaves on which they were found.

In a certain marshy place where I have seen, in different years, numerous masses of eggs of *T. atratus* I noticed that these masses were nearly always found on the same species of *Scirpus* and situated very much alike in the great majority of cases.

I have watched several females of *C. callidus* during the entire process of oviposition which in this species usually occupies from twenty minutes to half an hour; during which time something like one to three hundred eggs are laid.

The female alights on the leaf head downward and begins by pushing the tip of her abdomen forward toward the sternum of the thorax and placing the protruding end of an egg against the leaf. This end sticks fast and she then moves the tip of her abdomen backward until its normal position is reached and the egg becomes free. By the same movement one or two eggs are then placed to one side of this one and two or three on the other side of it. The unfinished end is soon observed to be V-shaped; the female moving very gradually forward and placing the end

of her abdomen to one arm of the V and depositing eggs along down until the apex is reached, then changing the tip of her abdomen to the outer part of the other arm of the V and placing eggs along down to the apex on this side.

This process is kept up, the female changing regularly to the outer part of the opposite arm of the V each time the apex is reached. Between nine o'clock and noon seems to be the favorite time of day for oviposition with the various species of both Chrysops and Tabanus, and I have seldom been able to observe females ovipositing at other hours of the day.

The eggs when first laid are clear white but gradually get darker until they become permanently dark brown or black. Most of the eggs of Chrysops are deep black, and are placed in a single layer, but there are exceptions to this, for the egg of *C. celer* are never darker than brown, and are placed in at least three layers one upon the other.

The color of eggs in Tabanus is variable between brown and black, and so far as I have observed, are always placed in convex masses composed of layers one upon the other. In sections of eggs just laid no great amount of development is observable, and we therefore conclude that eggs are laid soon after they are fertilized. Temperature has its influence on the incubation period, and for this reason the length of time required for the hatching of Tabanid's eggs can not be said to be exactly so many hours. For instance, it took eggs of *Chrysops callidus* five or six days to hatch, and it required about a day longer in the case where eggs were kept in the shade the whole time, than in cases where the eggs were in the sun during the daytime.

Eggs of *Tabanus stygius* hatched in about seven days in each of the two or three trials I gave them. In all species observed all the eggs of a single mass hatch very near the same time, and the whole mass of wriggling larvæ go tumbling down into the water together. Once in the water they separate and sink to the muddy bottom, where they conceal themselves so securely that they are not usually seen again until they appear as adults. Sometimes there are a few eggs that are slow in hatching, and larvæ from these come out and drop to the water singly or in small groups.

LARVA AND PUPA.

The larvæ of the different species of this family are very much alike in appearance, except in size, consequently the full grown larvæ of the small species are hardly distinguishable from younger larvæ of the large species. They are tapering at each end, shining whitish in general color, and many of the larger specimens at least, are banded with dark brown or black.

The pupæ studied are dull yellowish in color, with an encircling row of spines or stiff hairs at the apical third of each abdominal segment. Characters for grouping the various species are located in the spiracles, and also in the denticles at the apex of the abdomen.

When the larva is first hatched a certain amount of yolk is present in connection with the alimentary canal, and this furnishes it food for a time. The young larvæ of all the species studied in this stage possess the burrowing habit, and whatever soft material, plant or animal, they can reach they at once burrow into. Consequently little opportunity is offered under natural conditions for studying their habits and growth. The larvæ of many of the specimens probably remain in the water or in the mud very near the edge of the water throughout the existence of this stage for their pupæ come to the surface of the ground a few inches from the edge of the water just before the adults issue; and around fresh water ponds I have observed myriads of pupa skins of Chrysops with just the anterior ends projecting above the surface of the ground. There is a wide range of variation in the habits of larvæ of various species of *Tabanus*. Some are hatched in stagnant pools, some in ripples of streams and some in marshy ground. Some species live in water for a time and crawl out into dry ground; consequently one often finds *Tabanid* larvæ by digging in dry ground along the borders of ponds. Larvæ are easily reared if taken when nearly full grown, and appear to be as much at home in moist ground as in water. They eat small, soft-bodied invertebrates of many kinds, even their own species. We have kept them from fall until the following spring in small covered dishes filled with wet earth. Plenty of moisture was applied and earthworms from a greenhouse near by were given for food. In order to prevent one larva from eating another of its species, only one was kept in each dish. In a large number of trials only a few have died before reaching maturity.

Not much can be said regarding the length of time our species remain in the larval stage, but from circumstances one is led to believe that, in some cases at least, more than one year is consumed by this stage. At Sandusky, Ohio, in July, 1901, *Tabanus stygius* was very common, but in 1902, at the same place, only one or two specimens were seen. It may be that one can account for this difference on the ground of more than one year being required for the completion of the larval stage.

FIELD HABITS OF THE ADULTS.

The adults have many peculiar habits which the collector should know in order to become proficient in procuring specimens; and besides, some of these habits have an economic bearing also. The larval stage is passed in the water or at least in

wet places, and where the larva attains its full growth, the change to the pupa of course takes place; and as the pupa cannot transport itself it is evident that most adults issue in the vicinity of water or marshy ground. The only exception to this I have noted is when the larva or pupa has been carried to remote places by high water. It is not an uncommon thing to meet with teneral specimens of various species clinging to grasses, reeds and other plants growing in wet ground, waiting for their wings to harden. At such times males and females are theoretically equal in numbers, and although not always as distinctly marked as older specimens, they are nevertheless desirable. The sexes of Chrysops may be procured thus when other efforts come to naught.

As is well known only the females suck blood, and are therefore the only sex that molests stock. The males procure their food from plants and consequently are to be looked for on flowers and foliage. In an endeavor to satisfy myself whether or not the females visit flowers, I have taken from various blossoms the past summer no less than half a dozen females of different species, but not in a single instance have I taken the male from animals. The statement appears in print that females visit flowers for food when they are compelled to do so, but it is probable that their visits to flowers are not necessarily compulsory on their part. It seems more plausible that these visits are made at times from choice.

The females of Chrysops and some of the species of *Tabanus* come buzzing around the collector in numbers, and at such times may be taken easily with a net. The majority of the species of *Tabanus* in this region, however, are very active, and as they seldom alight on man for the purpose of sucking blood, not many are taken in the way just stated.

During the time the female is ovipositing the male is often resting near by on the foliage. At Georgesville, Ohio, June 4th, I observed *C. moechus* ovipositing on foliage overhanging a mill race; soon after specimens of the male sex were observed resting on the upper leaves of the same plant on which the females were ovipositing. In a few minutes collecting, a dozen or more specimens of each of the sexes were procured.

The sexes of many species of *Tabanus* often alight on the bare ground of paths or roads that run through the woods. At Cincinnati, June 10th, in company with Mr. Dury, we procured numbers of the sexes of different species resting on some furrows that were plowed around a woods to prevent the spread of fire. We also took the same species resting in paths and roads that ran through the woods. Some of these same species were

also taken from the low growing foliage in sunny places among the trees.

One of the best places I have ever found for taking the sexes of *Tabanus* and *Chrysops* is in the tall grass that skirts the marshes of Sandusky Bay. This grass is the *Phragmites* of botanists and grows to a great height. On July 6th, at Black Channel, when the wind was high, I went into a patch of this grass that was so dense that a net could not be used in it to advantage. Here *Tabanids* were abundant, and it was found that by approaching them very carefully, specimens could readily be picked off with the fingers. The male and female of *T. stygius*, *nivosus*, *C. moerens* and *brunneus* and the male of *T. affinis* and *bicolor* were taken in this way. This same grass furnished excellent collecting wherever found, but most material was procured when the wind was high. On the same date and near the same place the male of *C. brunneus* was taken from the flowers of the common spatter-dock, and this and *moerens* were procured by sweeping in the adjacent low-growing herbage.

Tabanus sulcifrons is an abundant species in northern Ohio during the latter part of July and all of August, and a fine opportunity for studying its mating habits has been presented. I have observed pairs of only two species of this genus in copulation, but so many pairs of *sulfifrons* have been noted in different years that it may be of value to record a few statements. All pairs have been observed before nine o'clock in the morning. On the 18th of last August I entered in my note book the following note: The day is clear and warm; *T. sulcifrons* abundant along the south side of a woods; between eight o'clock and half past eight several pairs observed copulating on the fence, and several pairs taken. The male in every instance clung to the edge of a rail, and the female with the legs and wings motionless and touching nothing hung suspended. The time occupied in making the observations on which this note is based was only a few minutes, considerably less than half an hour, and as I had been in the field where the species was abundant for some time previous and stayed for some minutes thereafter, and saw no pairs except as stated above, it would seem that the period for taking observations on the mating habits of *T. sulcifrons* is not a long one, and perhaps accounts for the scarcity of printed statements regarding this particular in our other species of the family. In an hour after these observations were taken hardly any specimens of either sex could be found in the vicinity.

The statement is in print regarding *Simulium*, which genus is composed of species having blood sucking females, that "since females once gorged with blood do not and can not return, copu-

lation and deposition of eggs must take place very soon after emergence from the water."* A careful examination was made of the females of the pairs taken in copulation to see if there was any indication of their having taken food previously. In several cases the alimentary tract was found to be well filled with blood. Two pairs were preserved in formalin, and when dissected the digestive system of the female contained a quantity of hardened blood, which when treated with glacial acetic acid yielded hæmin crystals.

Pangonia rasa, which is the only species of its genus so far taken in Ohio, has been found on flowers only. From what I have observed the female of this species has a special liking for flowers, for specimens have been taken from these when cattle were grazing near by at the time.

Goniops chrysocoma appears to be a common species in the state, but I have never seen it around stock. The females have been taken most often in woods resting on foliage of both herbaceous and woody plants. This sex may often be located by the noise made in vibrating the wings rapidly and striking the leaf at each downward stroke. Specimens have often been taken from dead leaves where the noise made is much louder than when the leaf is green. The males fly rapidly, and at intervals come to rest on low growing plants where they remain for a time; then they take wing again and are away so rapidly that the eye cannot follow them. Males at rest are easily approached, and this sex has been taken about as often as has the female.

Many, if not all, of the Tabanidæ in both sexes have the habit of coming to the water, and lowering themselves to its surface, dip several times in succession, and then fly away to alight on the bank or disappear from sight altogether. Writers have said that this is done for the purpose of drinking, and that at each dip a small quantity of water is taken up by the proboscis. This habit has an economic bearing which will be discussed on another page of this paper.

ANATOMY OF *TABANUS SULCIFRONS* MACQUART.

Tabanus sulcifrons, on account of the ease with which numerous specimens can be procured, has been chosen for the subject of a short study of anatomy.

In this study it has been the aim to use names which are in most common usage by the more prominent dipterologists, but sometimes a choice of one of the many names that have been used for a single region is a rather difficult matter.

* Report U. S. Commissioner of Agriculture for 1886, 509.

In order to study certain parts closely and locate their boundaries it is necessary to remove the vestiture which is most abundant on the face and sides of the thorax.

Head of female. The anterior part of the head is largely occupied by the compound eyes which are brown in color, and each is crossed transversely by two narrow, slightly curved, greenish or purplish bands.

The *antennae* are located on the lower middle of the head, and each is composed of three segments of which the third bears near its base an angular prominence which may be called the *upper angle* or *basal prominence* of the third antennal segment. Also this segment is compound, being composed of five annulations of which the basal one is longer than the other four taken together.

The *front* or *frons*, which is the region between the eyes above the antennae is nearly of the same width throughout. The space just above the antennae, the *subcallus*, is pollinose in this species. Above the subcallus is the *frontal callosity*, which is naked and shining, and occupies nearly the whole width of the lower part of the front. It is quadrangular in form, with a narrow elongate extension upward from its superior side.

The upper part of the front is the *vertex*, and the limit of the front above is the *vertical margin*. The *face* occupies the space bounded by the antennae, eyes and *oral margin*.

The middle part of the face beneath the antennae is swollen, while on each side is a less elevated area known as the *cheek*. The lower part of the face passes to the oral margin and the proboscis. The part of the proboscis which is visible in nature is largely *labium*.

The labium is grooved on the upper side, and into this groove the other mouth parts, with the exception of the palpi, are received. It may be likened to a sheath for the edges of the groove are extended and meet above, for at least a part of the length. Its distal part is furnished with an enlargement, the *labella*, which when the insect is taking food becomes a sucking disk.

The mouth parts which are received into the groove of the labium consist of six stylets, which are light brown in color and otherwise resemble one another. If these be separated from the labium, the *labrum* may be seen farthest forward and just behind it the smaller *hypopharynx*. Next in order passing backwards are the *mandibles* lying side by side while the *maxillae* the narrowest of the mouth parts lie posterior to the mandibles. Each maxilla has attached to its base a large *maxillary palp*, which is composed of a shorter basal, and a larger and longer distal joint. These maxillary palps in their natural position are very promi-

ment, the proximal joint projects forward so that the large distal segment is carried before all the other mouth parts.

The rear of the head is usually referred to simply as the *occiput*, near the middle of which the head is joined to the thorax, a narrow strip lying above this junction is sometimes referred to as the *nape* or *cervix*. The cervix in this species is quite obviously bounded by sutures.

Head of male. The head is larger and approaches nearer to hemispherical than in the female. The eyes are continuous for a long distance and thus the front is divided into two parts called the *vertical* and *frontal triangles*. The former is very small and is bounded above by the vertical margin and bears no *ocelli* or simple eyes in this species. The latter is limited below by the antennæ and includes the subcallus. Because of the increased size of the head the antennæ appear to have their union higher up.

The face in this sex is different than in the female. The sides or cheeks are about in the same plane with the surface of the eyes while the median part is much depressed. The mouth parts also differ; the mandibles are entirely lacking and some of the other parts are noticeably reduced. The second joint of the maxillary palp is smaller and shorter than in the female, and turns upward to lie against the face. The uppermost greenish band of the eye is abbreviated outwardly and just above it, next the frontal triangle, is the division between the lower area of small facets and the upper area of large facets of which the eye is composed. On the outer and upper margin of the eye the area of small facets is extended to where the eye meets the vertex triangle.

Thorax. The three primary divisions of the thorax are not easily separated, but the *mesothorax* comprises nearly all the space visible from above, including the posterior, somewhat triangular portion called the *scutellum*.

The *prothorax* is small but is easily located from the fact that it bears the anterior pair of legs. A small lobe of the prothorax, easily distinguished by being lighter in color, is closely applied to each anterior corner, or *humerus* of the mesothorax. Lying between the attachment of the anterior leg and the humerus are two small prominences and just posterior to these latter is the *anterior thoracic spiracle* which marks the beginning of a suture, the *dorso-pleural suture*, which passes backward through the attachment of the wings, and ends beneath the front edge of the scutellum.

The dorso-pleural suture marks the division between the superior and lateral parts of the mesothorax, known respectively

as *dorsun* and *pleura*; at the sides of the middle of the dorsum is a suture, furcate below and obsolete above, the *transverse suture*.

In Diptera it seems not to be definitely settled as regards the downward extension of the *pleura*, but "the inferior surface of the thorax between the legs" has received the name of *pectus*.

The *metathorax* is small and the *metanotum*, which is the part of it visible from above, may be seen beneath the scutellum, by viewing from behind.

Passing toward the *pectus* on each side we observe a prominence called the *lateral callosity* of the *metathorax*. Behind the lateral callosities are located the poisers or *halteres*, and just beneath them the *posterior thoracic spiracles*.

The *prothorax* bears a pair of legs, the *mesothorax* a pair of legs and the pair of wings, and the *metathorax* a pair of legs and a pair of *halteres*.

The legs are each composed of five sections; the *coxa* next the thorax, and following in succession the *trochanter*, *femur*, *tibia* and *tarsus*. Each tarsus contains five segments of which the last or fifth bears a pair of *claws*, a pair of pads or *pulvilli* beneath the claws, and between the *pulvilli* a single *empodium*, which is developed similar to the *pulvilli*. The *prothoracic coxæ* are slightly more than half as long as the femora of these legs, while the *coxæ* of the other legs are very much shorter.

There seems to be no notable difference between the legs of male and female except in the front feet where the male claws, *pulvilli* and *empodii* are much larger than the same parts in the female.

By taking a specimen of *Tabanus* with its wings spread and following the posterior border of a wing toward the body one finds toward the base an incision, the *axillary incision*, between which and the scutellum are three membranous lobes. These in order are called *alula*, *antitegula* and *tegula*.

The first, bordering the axillary incision, is considered as a part of the wing proper, but the other two called *tegulae* when taken together are usually considered as accessory. In closing the wing it is seen that the *antitegula* moves with the wing while the *tegula*, although joined with the *antitegula* is also securely joined with the thorax, remains practically stationary. When the wing is closed the *antitegula* fits over the *tegula* and nearly hides it from view. The *halteres* have their attachment beneath the *tegula*, therefore their basal parts are concealed, but the apical yellow knobs are always visible.

Wing. Plate II shows the regions and venation of a wing of *Tabanus stygius* Say, and reference to the drawing will make it easy to locate them.

Many species of *Tabanus* have the wings entirely transparent while others have dark areas which furnish distinctive characters. In *T. sulcifrons* dark markings are located at the bifurcation of the third vein and along the veins at the discal end of the discal cell; when markings are present on the wings of the various species of *Tabanus* it is more common to find them where the third vein branches and along the veins or parts of veins which are most nearly transverse. Exceptions to this may be seen by reference to *venustus* and *turbidus*.

Abdomen. The markings of the abdomen in this species consist of rather broad white triangles and white posterior margins on most of the segments. These markings are formed by the color and arrangement of the vestiture, which consists of hairs and dust or pollen. With a bristle brush the hair may be easily removed from a dry specimen, but on the same kind of a specimen the pollen is more persistent and therefore more readily removed by rubbing after it has been moistened.

When all the vestiture has been removed the abdomen is nearly a uniform brown all over and appears quite different than in a perfect specimen.

Seven segments are visible to the unaided eye. The circumference decreases from the second backward, and concealed by the seventh or smallest are what may be considered as three very much reduced additional segments, which are easily removed by the aid of a needle and which can only be differentiated satisfactorily by the use of a microscope or strong lense. These segments besides being smaller are much modified in both sexes. In the female from ventral view, is visible a sclerite, *infraanal plate*, which is interesting from a specific standpoint, and its form may be seen best by reference to Fig. 9, q. plate I.

The *claspers* of the male are borne by the eighth segment, each of these are composed of two joints, which are movable; therefore they appear different in different specimens as may be seen by reference to the figures, plate I, Figs. 6 and 10.

MALES COMPARED WITH FEMALES.

The males and females in the entire family are easily distinguished from the fact that the former sex has the eyes contiguous and the latter has the eyes plainly separated. In all the species studied the male has the proboscis longer and slenderer, and the front feet larger than in the female. The palpi in the female point downward and the second segment is carried in front of the proboscis, while in the male they often turn upward and the second segment is carried against the face.

Usually the males and females of the same species are easily associated, but in a number of species it is not an easy matter at least until they have been taken in the same locality in the field.

In Chrysops the apex of the wing beyond the cross-band is marked the same in both sexes even though the difference in coloration between the male and female is striking. This is noticeable in *C. mœchus* in which the female is largely marked with yellowish while the male is entirely black. The base of the wings of the males of nearly all of the species of Chrysops have more black than do the females, and in some species like *celer* the female has the sides of the thorax densely clothed with yellow pile while the same parts in the male are less densely clothed with black pile giving the two sexes a very different appearance.

In the female of *Tabanus stygius* the dorsum of the thorax is clothed with white pollen, while in the male this is largely lacking, thus giving the sexes a very different appearance.

The sexes of *Goniops chrysocoma* are notably different in appearance, because of the fact that the whole body is black in the male and light yellowish in the female.

ARTIFICIAL REMEDIES.

Various species of the family are very annoying to stock, but although their biting habits have been known for years no generally practical remedies have been suggested for their control. Work horses may be protected by the use of fly-nets, and burlap blankets are often used on cattle and horses, but these blankets have their objectionable features, and it is doubtful if they come into general use in the near future. Kerosene emulsion, carbolic acid, fish oil and a variety of substances have been used, and beneficial results have been obtained from a number of them, but the benefits derived from a single application are of such short duration that to many their use is thought to be impracticable.

The most valuable results in destroying horse flies were obtained by Porchinski in Russia, and are described by Howard in a paper published in Bulletin number 20, new series, of the U. S. Division of Entomology. The method employed consists in applying kerosene to the surface of stagnant water for the purpose of coming in contact with the adults when they come to drink. It may be added from my own observations that the same application is of consequence in killing larvæ at the time they hatch and drop into the water. As the eggs of so many of our species are deposited over water and the larvæ drop down into the water when they hatch, I am of the opinion that more striking results may be obtained from the use of kerosene on the surface of stagnant water in destroying larvæ than in destroying adults.

NATURAL ENEMIES.

Some years ago Hart reared a hymenopterous parasite, *Panurus tabanivorus*, from the eggs of *T. atratus*. This appears to be a common parasite, and I have reared more than a hundred specimens from a single cluster of eggs.

It is very common to find clusters of eggs of both *Tabanus* and *Chrysops* more or less injured by being eaten into and some of the eggs destroyed. Various predaceous insects have been observed to be responsible for this condition of things.

Around ponds where Tabanids are issuing many specimens fall a prey to predaceous insects of different orders. Tabanids fresh from the pupa case are not active and require time for their wings to harden before they fly readily. I have observed two species of Hemiptera, *Limnobates marginatus* and *Phytocoris nubilis*, preying upon teneral adults of *Chrysops callidus*; and E. B. Williamson has sent in teneral specimens of *Chrysops vittatus* taken from *Mesothemis simplicicollis*, one of our commonest dragonflies. Robber flies of the family Asilidæ, which appear to have no choice of species when capturing their prey, have occasionally been captured with specimens of *Tabanus* in their possession.

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Harris, Dr. Thaddeus W.

8. Catalogue of the Insects of Massachusetts. In Hitchcock's Report on the Geology, Botany and Zoology of Massachusetts; second edition, 1835.

Jaenicke, F.

9. Neue exotische Diptern aus den Museen zu Frankfurt und Darmstadt. In the Abhandl. d. Senckenb. Ges. Volume 6, with two plates. Also separately in one quarto volume of 100 pages. Frankfurt, 1867.

Kirby, Will.

10. Fauna Boreali Americana. Volume 4, 1837.

Loew, Dr. H.

11. Diptera Americae Septentrionalis indigena; parts 1-10, Part 8 contains the description of *Pangonia pigra*. Part 10 contains the description of *Silvius gigantulus*.

Macquart, J.

12. Histoire Naturelle des Diptères, two volumes, 1834-35.
13. Diptères Exotiques nouveaux ou peu connus. Two volumes in five parts, five supplements and 186 plates. Paris, 1838-55.

Palisot de Beauvois, A. M. F. J.

14. Insectes recueillis en Afrique et en Amérique, etc. Paris, 1805-21.

Say, Thomas.

15. The Complete Writings of Thomas Say on the Entomology of North America. Leconte's edition, two volumes, 1859.

Walker, Francis.

16. List of the Specimens of Dipterous Insects in the Collection of the British Museum; four parts and three supplements, 1848-55. Most of the Tabanidae are treated in the first part and the first supplement.
17. Insecta Saundersiana, or characters of undescribed insects in the collection of W. W. Saunders—Diptera. Five parts, with eight plates by Westwood. London 1850-56.

Westwood, J. O.

18. Insectorum novorum exoticorum ex ordine dipterorum descriptiones. In the London and Edinburgh Philosophical Magazine, 1835. *Pangonia macroglossa* is described.

Wiedemann, C. R. W.

19. Aussereuropäische Zweiflügelige Insecten. Two volumes, with plates. Hamm 1828-30.
20. Diptera exotica. Kiliae 1821.

THE MORE IMPORTANT PAPERS ON NORTH AMERICAN TABANIDÆ,
BEGINNING WITH OSTEN SACKEN'S PRODROME.

Aldrich, J. M.

21. A New Genus and Species of Tabanidae. Psyche, VI, 236, 1892. *Goniops hippoboscoides* is described. On page 246 of the same volume is a note stating that figure 3 on page 237 is printed upside down.
22. *Goniops* and other Synonyms. Entomological News, XI, 531, 1900.

Bigot, J. M. F.

23. Diptères nouveaux ou peu connus.
Bulletin de la Société Zoologique de France; XVI, 74-79, 1891.
A synoptic table of the genus *Haematopota*.
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Memoires de la Société Zoologique de France, V, 602-691, 1892.
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26. Papers from the Harriman Alaska Expedition, Diptera. Proceedings of the Washington Academy of Sciences, II, 389-464, 1900.
Tabanidae, 406.
27. New Orthorrhaphous Diptera from Mexico and Texas. Journal of the New York Entomological Society, X, 136-141, 1902.
Tabanidae, 137.

Hart, Charles A.

28. On the Entomology of the Illinois River and Adjacent Waters: family Tabanidae. Bulletin of the Illinois State Laboratory of Natural History, IV, 220-247, 1895. The Tabanidae known from Illinois with extensive notes on the life-history habits of many species.

Hine, Jas. S.

29. *Pangonia chrysocoma* Osten Sacken. Entomological News, XI, 392, 1900.
30. Description of two new Species of *Tabanus*. Canadian Entomologist, XXXII, 247, 1900.
31. Change of Name. Canadian Entomologist, XXXIII, 28, 1901. The name *pruinus* changed to *ohioensis*.
32. Collecting Tabanidae. The Ohio Naturalist, II, 147, 1901.

Howard, L. O.

33. A Remedy for Gadflies, Porchinski's Recent Discovery in Russia, with some American Observations. Bulletin 20, New Series, Division of Entomology, United States Department of Agriculture, page 24, 1899.
34. The Insect Book. 1901. The Family Tabanidae is treated on pages 131-133. Several species are figured in plates XV and XVI.

Johnson, Charles W.

35. List of the Diptera of Jamaica with Descriptions of New Species. Proceedings of the Academy of Natural Sciences of Philadelphia, 1894, 272. List of the Species only.
36. Diptera of Florida. Proceedings Academy Natural Sciences of Philadelphia, 1895, 321. List of Species.
37. Insects of New Jersey. New Jersey State Board of Agriculture, 1899. Tabanidae pp. 639-642.
38. Some Notes and Descriptions of seven new Species and one new Genus of Diptera. Entomological News, XI, 323-328, 1900.
Theriopectes politus is described on page 325.

Kértész, Dr. Colomannus.

39. Catalogus Tabanidarum Orbis Terrarum Universi. Edited by the Hungarian National Museum, Budapest, 1900.

Marten, John.

40. New Tabanidae. Canadian Entomologist, XIV, 210-212, 1882.
41. New Tabanidae. Canadian Entomologist, XV, 110-112, 1883.

Osborn, Herbert.

42. Insects affecting Domestic Animals. Bulletin No. 5, New Series, Division of Entomology, U. S. Department of Agriculture, page 58-71, 1896. An Economic Account.

Osten Sacken, Charles R.

43. Prodrôme of a Monograph of the Tabanidae of the United States. Memoires of the Boston Society of Natural History, Part I. The Genera Pangonia, Chrysops, Silvius, Haematopota and Dibasis; volume II, 365, 1875. Part II, The Genus Tabanus; volume II, 421, 1876. Part III, Supplement; volume II, 555, 1876.
44. Western Diptera. Descriptions of New Genera and Species of Diptera from the region west of the Mississippi River and especially from California. Bulletin of the United States Geological and Geographical Survey of the Territories. Volume III. Tabanidae pp. 213-223, 1877.
45. Catalogue of the Diptera of North America. Smithsonian Miscellaneous Collections No. 270, 1878. Tabanidae pp. 52-62 and 225-229; notes 64-90.
46. Diptera. Biologia Centrali Americana, I, Tabanidae pp. 43-60, 1886.

Ricardo, Miss Gertrude.

47. Notes on the Pangoninae of the Family Tabanidae in the British Museum Collections. Annals and Magazine of Natural History, series 7, volume V, pp. 97-121, 1900. Series 7, volume V, pp. 167-182, 1900. Series 7, volume VIII, pp. 286-315, 1901. Series 7, volume IX, pp. 366-381, 1902.

Riley, Charles V.

48. Noxious, Beneficial and other Insects of the State of Missouri. Second Annual Report, pp. 128-132. The immature stages of *Tabanus atratus*.

Slossen, Anna T. Mrs.

49. List of Insects taken in Alpine Region of Mount Washington. Entomological News, V, 1; VI, 4; VI, 316; VII, 262; VIII, 237; IX, 251; XI, 319; XIII, 4; XIII, 319.

Townshend, C. H. Tyler.

50. Contributions to the Dipterology of North America, II. Tabanidae, Conopidae Tachnidae, etc. Transactions of the American Entomological Society, XXII, 55-80, 1895. Tabanidae, pp. 56-60.
51. The Diptera of Baja California. Proceedings of the California Academy of Sciences, Series II, volume IV, pp. 593-620, 1895. Tabanidae, pp. 595-598.
52. On the Horse-flies of New Mexico and Arizona. Transactions of the Kansas Academy of Sciences, 1894, 133-135.
53. On a Collection of Diptera from the Lowlands of the Rio Nautla in the State of Vera Cruz, Mexico. Annals and Magazine of Natural History, Series 6, volume 19, 1897. Tabanidae 18-19. Series 6, volume 20, 1897. Tabanidae pp. 21-23.

54. Diptera from the Headquarters of the Gila River. *Psyche*, VIII, 1897. Part I, Tabanidae 38-40. Part II, 92-93.
55. Diptera from the Mesilla Valley of the Rio Grande, New Mexico. *Psyche*, VIII, 147, 1897. *Diachlorus guttatus* is a *Tabanus*.
56. Diptera from Yucatan and Campeche. *The Canadian Entomologist*, XXIX, 197-199, 1897.
57. Some Characteristic Maritime Diptera from the South End of Padre Island and the Adjacent Texas Coast. *Entomological News*, IX, 167-169, 1898.
58. Diptera from the Lower Rio Grande or Tamaulipan Fauna of Texas. *Journal of the New York Entomological Society*, VI, 50, 1898.

Whitney, C. P.

59. Descriptions of some new species of Tabanidae. *Canadian Entomologist*, XI, 35, 1879. Six new species described.

Williston, Samuel Wendell.

60. Some interesting new Diptera. *Transactions of the Connecticut Academy of Arts and Sciences*, IV, 243-246, 1880. Two new species of Tabanidae described on pages 244-246.
61. Collection and Preservation of Diptera. *Psyche*, IV, 130-132, 1884.
62. Diptera. *Standard Natural History*, II, 416-417. 1884.
63. On the Classification of North American Diptera. *Entomologica Americana*. Volume 1, 10-11 and 12-13, 1885. Synoptic table to genera of North American Tabanidae and Description of *Apatolestes comastes*, new genus and species.
64. Synopsis of the Families and Genera of North American Diptera, pp. 1-84, 1888.
65. Notes and Descriptions of North American Tabanidae. *Transactions of the Kansas Academy of Science*, X, 129-142. 1888. This paper is supplementary to Osten Sacken's *Prodrome*.
36. On the Diptera of St. Vincent. *Transactions of the Entomological Society of London*. 1896, pp. 253-446. The Tabanidae, 302-303.
67. A list of species of Diptera from San Domingo. *Canadian Entomologist*, XXV, 170-171. 1893.
68. *Manual of the Families and Genera of North American Diptera*. 1896. Published by J. T. Hathaway, New Haven, Connecticut.
69. Tabanidae. *Biologia Centrali Americana*. Supplement to volume I, pp. 252-264, 1901.

CATALOGUE OF TABANIDÆ FROM AMERICA NORTH OF MEXICO.

The following catalogue is presented for the purpose of giving the distribution, synonymy and bibliography of the species from America north of Mexico. A few species not yet reported from north of the Mexican boundary are included, but southern species are added to our fauna from time to time and it is likely many others will be added from Mexico when extensive collections can be secured from our southern states.

The bibliography does not include all references but only such as are of value in characterizing or extending the range of the species given.

Names in italics are synonyms of the one in Roman above. There are many other synonymous names in the list but evidence at hand is not sufficient to locate them. The names that have been proposed for our species are brought together as a basis for future work. Many of the types of the older students of the family are not in existence at the present time, and it is likely that later students have sometimes redescribed their species under other names; so it is no small task to solve present problems in a satisfactory way.

There are a few names in older works given to species with habitat unknown; some of these names may have been given to specimens from this region. Such names, and a few others excluded for other reasons, are not given in the list which follows.

CHRYSOPTERIS Meigen.

Illiger's Magazine II, 367, 1803.

- brunneus* Hine. Described in this paper. Habitat; Sandusky, Ohio.
- callidus* Osten Sacken. Prodrôme I, 379, 1875. Williston, Trans. Kan. Acad. X, 132. Habitat; N. C., D. C., Md., O., Ind., N. J., Del., Conn., Mich., Ills., Fla.
- carbonarius* Walker. List I, 203, 1848. Ricardo, Ann. Mag. Nat. Hist., Ser. 7, VIII, 303. Habitat; Me., N. H., Mass., Col., Wyo., Canada, N. J.
- niger* Walker (not Macq.). List I, 202, 1848.
- provocans* Walker. Dipt. Saund. I, 73, 1850.
- (?) *atra* Macquart. Dipt. Exotic Supp. 4, 40, 1850.
- fugax* Osten Sacken. Prodrôme I, 375, 1875. Williston, Trans. Kan. Acad. X, 132.
- celer* Osten Sacken. Prodrôme I, 376, 1875. Habitat; Me., N. C., Ohio, Mass., N. J.
- (?) *cincticornis* Walker. List I, 201, 1848. Ricardo, An. Mag. Nat. Hist., Ser. 7, VIII, 302.
- ceras* Townsend. Psyche VIII, 38, 1897. Habitat; N. M.
- coloradensis* Bigot (in part). Mem. Soc. Zool. Fr. V, 605, 1892. Ricardo, Ann. Mag. Nat. Hist., Ser. 7, VIII, 397. Habitat; Colorado.
- cuelux* Whitney. Can. Ent. XI, 35, 1879. Habitat; N. H., Me., Pa.
- cursim* Whitney. Can. Ent. XI, 36, 1879. Williston, Trans. Kan. Acad. X, 134. Habitat; N. H.
- delicatulus* Osten Sacken. Prodrôme I, 380, 1875. Habitat; N. H., Me.
- discaelis* Williston. Trans. Conn. Acad. IV, 245, 1880. Habitat; Wyo., Col.
- divisus* Walker. List I, 204, 1848. Ricardo, Ann. Mag. Nat. Hist., Ser. 7, VIII, 303. Habitat; Fla.
- atropos* Osten Sacken. Prodrôme I, 372, 1875.
- excitans* Walker. Dipt. Saund. 72, 1850. Osten Sacken, Prodrôme I, 373. Habitat; Me., N. H., Pa., Wash., B. C., Ills.
- facialis* Townsend. Psyche VIII, 39, 1897. Habitat; N. M.
- fallax* Osten Sacken. Prodrôme I, 392, 1875. Habitat; Mass., N. Y., Del., N. J., Md., Ohio.

- flavidus* Wiedeman. Dipt. Exot. I, 195, 1821. Auss. zweifl. Ins. I, 199. Osten Sacken, Prodrôme I, 385. Habitat; Md., N. J., D. C., Miss., N. C., Fla., Ohio.
- canifrons* Walker. List I, 197, 1848.
- pallidus* Bellardi. Saggio I, 73, 1859, pl. II, fig. 16.
- frigidus* Osten Sacken. Prodrôme I, 384, 1875. Prodrôme II, 474. Habitat; N. H., N. Y., Wash., Ohio, British Possessions.
- fulvaster* Osten Sacken. Western Dipt. 221, 1877. Ricardo, Ann. Mag. Nat. Hist., Ser. 7, VIII, 306. Habitat; Col., Utah, Wyo., Ariz., N. M., Montana.
- coloradensis* Bigot (in part). Mem. Soc. Zool. Fr. V, 605, 1892.
- furcatus* Walker. List I, 199, 1848. Osten Sacken, Prodrôme I, 391. Ricardo, Ann. Mag. Nat. Hist., Ser. 7, VIII, 302. Habitat; N. Y., Hudson Bay.
- hilaris* Osten Sacken. Prodrôme I, 391, 1875. Habitat; Me., N. H., N. Y., Canada.
- indus* Osten Sacken. Prodrôme I, 383, 1875. Habitat; N. Y., N. J., Canada, Ohio.
- lugens* Wiedeman. Dipt. Exot. I, 109, 1821. Auss. Zw. I, 212. Habitat; Ohio, Md., N. C., Ga., Fla., N. J.
- morosus* Osten Sacken. Prodrôme I, 389; II, 474, 1875.
- (?) *trinotatus* Macquart. Dipt. Exot. I, pt. 1, 161, 1838.
- mitis* Osten Sacken. Prodrôme I, 374, 1875. Habitat; Washington.
- moechus* Osten Sacken. Prodrôme I, 387, 1875. Habitat; N. J., D. C., Ills., Ohio, Ky.
- moerens* Walker. List I, 201, 1848. Ricardo, Ann. Mag. Nat. Hist., Ser. 7, VIII, 302. Habitat; Ills., N. D., Wis., Ohio.
- aestuas* van der Wulp. Tijd. Ent. X, 135, 1867 pl. III, fig. 8 and 9. Osten Sacken, Prodrôme I, 378.
- montanus* Osten Sacken. Prodrôme I, 382, 1875. Townsend, Tr. Am. Ent. Soc. XXII, 57. Habitat; D. C., Md., Ohio, N. Y., Ills., Vt., N. J.
- niger* Macquart. Dipt. Exot. I, 161, 1838. Walker, List I, 202; List V, 282. Osten Sacken, Prodrôme I, 377. van der Wulp, Tijd., Ento. XXIV, 161. Townsend, Tr. Am. Ent. Soc. XXII, 57. Habitat; Pa., Me., N. C., Tenn., Va., Ohio, Canada, N. J.
- carbonarius* Walker (in part). List I, 203, 1848.
- nigribimbo* Whitney. Can. Ent. XI, 36, 1879.
- nigripes* Zetterstedt. Insecta Lapponica I, 519, 1840. Loew, Vehr. Zool. Bot. Ges. VIII, 336. Osten Sacken, Prodrôme I, 394. Coquillett, Wash. Acad. Sci. II, 406. Habitat; Lapland, Sitka.
- noctifer* Osten Sacken. Western Diptera 220, 1877. Habitat; California.
- obsoletus* Wiedeman. Dipt. Exot. I, 108, 1821. Auss. Zweifl. Ins. I, 211. Osten Sacken, Prodrôme I, 393. Habitat; Md., D. C., N. C., Ks., Me., N. J., Mass., Ohio.
- pachycerus* Williston. Tr. Kan. Ac. Sci. X, 134, 1887. Habitat; California.
- pertinax* Williston. Tr. Kan. Ac. Sci. X, 132, 1887. Ricardo, An. Mag. Nat. Hist. Ser. 7, VIII, 307. Habitat; Cal., Washington.
- nigriventris* Bigot. Mem. Soc. Zool. Fr. V, 604, 1892.
- plangens* Wiedeman. Auss. zweifl. Ins. I, 210, 1828. Osten Sacken, Prodrôme I, 393. Ricardo, Ann. Mag. Nat. Hist. Ser. 7, VIII, 301. Habitat; Fla., Ga., N. J., Conn.
- fuliginosus* Wiedeman. Dipt. Exot. I, 109, 1821. Auss. zweifl. Ins. I, 210.

- proclivis Osten Sacken. West. Dipt. 222, 1877. Ricardo, Ann. Mag. Nat. Hist. Ser. 7, VIII, 306. Habitat; Cal., Wash., Col., Oregon.
- atricornis* Bigot. Mem. Soc. Zool. Fr. V, 603, 1892.
- pudicus Osten Sacken. Prodrôme I, 381, 1875. Prodrôme II, 474. Williston, Tr. Ks. Acad. Sci. X, 134. Habitat; Mass., N. Y., N. J., N. C., Fla.
- sackeni Hine. Described in this paper. Habitat; Sandusky, Ohio.
- sepulchralis Kirby (not Fabricius). Fauna Bor. Am. Ins. 314, 1837. Osten Sacken, Catalogue 1878, 54.
- sequax Williston. Tr. Kas. Acad. Sci. X, 133, 1887. Habitat; Kansas.
- sordidus Osten Sacken. Prodrôme I, 376, 1875. Williston, Tr. Ks. Acad. Sci. X, 131. Ricardo, An. Mag. Nat. Hist. Ser. 7, VIII, 305. Habitat; White Mts., N. H., British Possessions.
- striatus Osten Sacken. Prodrôme I, 391, 1875. Habitat; Ill., D. C., N. J., Mexico, Ohio.
- vittatus* Bellardi (not Wiedeman). Sag. Ditt. Mess. I, 74, 1859.
- surdus Osten Sacken. West. Dipt. 223, 1887. Williston, Tr. Ks. Acad. Sc. X, 134. Habitat; California.
- univittatus Macquart. Dipt. Exot., suppl. 5, 36, 1855. Osten Sacken, Prodrôme I, 387. Habitat; Pa., N. C., La., Md., N. J., Ills., Ohio, Fla.
- (?) *fascipennis* Macquart. Hist. Nat. Dipt. I, 216, 1834. Walker, List I, 197, (var?). List V, 288.
- vittatus Wiedeman. Dipt. Exot. I, 106, 1821. Auss. zweifl. Ins. I, 200. Macquart, suppl. 5, 37. Osten Sacken, Prodrôme I, 390. Townsend, Tr. Am. Ent. Soc. XXII, 57. Ricardo, An. Mag. Nat. Hist. Ser. 7, VIII, 300. Habitat; Eastern North America, as far west as Kansas and Iowa.
- areolatus* Walker. List I, 197, 1848.
- lineatus* Jeannicke. Neue Dipt. Exot. 26, 1868.

PANGONIA Latreille.

Hist. Nat. des Crust. et des Ins. III, 1802.

- californica Bigot. Mem. Soc. Zool. Fr. V, 618, 1892. Habitat; Cal.
- dives Williston. Tr. Ks. Acad. Sci. X, 130, 1886. Habitat; California.
- fera Williston. Tr. Ks. Acad. Sci. X, 130, 1886. Habitat; Mt. Hood, Oregon.
- hera Osten Sacken. West. Dipt. 214, 1877. Habitat; San Francisco, Cal.
- incisa Wiedeman. Auss. zweifl. Ins. I, 90, 1828. Habitat; Ark., Col., N. M., Oklahoma.
- incisuralis* Say, Jr. Ac. Nat. Sc. Phil. III, 31, 1823; Compl. Writings, I, 75.
- isabellina Wiedeman. Auss. zweifl. Ins. I, 112, 1828. Osten Sacken, Catalogue 1878, 225. Habitat; North America.
- macro glossa Westwood. Lond. Edinb. Phil. Mag. 1835. Osten Sacken, Prodrôme I, 368, 1875. Habitat; Georgia.
- pigra Osten Sacken. Prodrôme I, 367, 1875. Habitat; N. Y., N. J., Ky., Fla.
- rasa Loew. Dipt. Am. sept. ind. pt. 8, no. 7, 1869. Osten Sacken, Prodrôme I, 366. Habitat; Ills., Wis., N. Y., Ky., Conn., Ohio.
- ruficornis Bigot. Mem. Soc. Zool. Fr. V, 615, 1892. Habitat; California.
- saussurei Bellardi. Saggio Ditt. Mess. I, 49, 1859. Habitat; Southern Arizona, Mexico.
- seminuda Coquillett, Jr. N. Y. Ene. Soc. X, 137, 1902. Habitat; Mexico.

- tranquilla* Osten Sacken. Prodrôme I, 367, 1875. Habitat; Penn., Mass., N. H., Canada.
velutina Bigot. Mem. Soc. Zool. Fr. V, 615, 1892. Habitat; California.

GONIOPS Aldrich.

Psyche VI, 236, 1892.

- chrysocoma* Osten Sacken. Prodrôme I, 368, 1875. Hine, Ent. News XI, 392. Aldrich, Ent. News XI, 531. Habitat; N. Y., N. J., Del., Pa., Ohio, Fla.
hippoboscoides Aldrich. Psyche VI, 236, 1892.

SILVIUS Meigen.

Syst. Besch. europ. zwei. Insecten III, 27, 1820.

- gigantulus* Loew. Dipt. Am. Sept. ind. pt. 10, no. 12, 1872. Osten Sacken, West. Dipt. 215; Catalogue 1878, 226. Habitat; Cal., Wash., B. C., N. M., Col.
trifolium Osten Sacken. Prodrôme I, 395, 1875.
pollinosus Williston. Tr. Conn. Ac. IV, 244, 1882; Tr. Ks. Ac. Sc. X, 131. Habitat; Kan., Col.
quadrivittatus Say, Jr. Ac. Phila. III, 33, 1823; Compl. Writ. II, 54. Wiedeman, Auss. zweifl. Ins. I, 200. Osten Sacken, Catalogue 1878, 226. Williston, Tr. Ks. Ac. Sc. X, 131. Habitat; Cal., Neb., N. M.

APATOLESTES Williston.

Entom. Americana I, 12, 1885.

- comastes* Williston. Entom. Amer. I, 12, 1885. Townsend, Tr. Ks. Ac. Sc. XIII, 134. Habitat; N. M., Cal.
eiseni Townsend. Pr. Cal. Ac. Sc., Ser. 2, IV, 596, 1895. Habitat; San Jose del Cabo, Lower California.

HÆMATOPOTA Meigen.

Illig. Magaz. II, 267, 1803.

- americana* Osten Sacken. Prodrôme I, 395, 1875. Habitat; Dakota, Mont., Col., Br. Col., Cal.
punctulata Macquart. Dipt. Exot. I, pt. 1, 163, 1838. Habitat; Carolina, Fla., N. J., R. I.

DIACHLORUS Osten Sacken.

Prodrôme II, 475, 1876.

- ferrugatus* Fabricius. Syst. Antl. 111, 1805. Wiedeman, Dipt. Exot. 1, 94; Auss. zweifl. Ins. 186. Walker, List I, 191; V, 148. Osten Sacken, Prodrôme I, 396; Biol. Cent. Am. I, 57. Habitat; Fla., Mexico.
americanus Palisot de Beauvois. Ins. Dipt. 222, tab. 3, fig. 6.
approximans Walker. List I, 198.
ataenia Macquart. Dipt. Exot. I, pt. 1, 152. Walker, List V, 271.
convergens Walker. List I, 198.
rondanii Bellardi. Saggio Ditt. Mess. I, 68, tab. 2, fig. 11.
haematopoides Bigot. Mem. Soc. Zool. Fr. V, 624, 1892. Habitat; Washington.
notatus Bigot. Mem. Soc. Zool. Fr. V, 623, 1892. Habitat; California.

TABANUS Linne.

Fauna Suecica 1761.

- abdominalis Fabricius. Syst. Antl. 96, 1805. Palisot de Beauvois, Ins. 101, tab. 2, fig. 4. Osten Sacken, Prodrôme II, 434; Supplement 557. Habitat; Ky., Ga., La., Miss., Ks., Ind., Ills., Fla., N. J.
- actaeon Osten Sacken. Prodrôme II, 443, 1876. Habitat; Mass., Conn., Min., Wis., Canada.
- acutus Bigot. Mem. Soc. Zool. Fr. V, 660, 1892. Habitat; La.
- aegrotus Osten Sacken. Western Diptera 219, 1877. Habitat; Cal., Washington.
- affinis Kirby. Faun. Bor. Am. IV, 313, 1837. Osten Sacken, Prodrôme II, 466. Habitat; northern U. S. and Canada from the Atlantic to the Pacific, N. J.
- triligatus* Walker. List V, 183, 1854.
- allynii Martin. Can. Ent. XV, 110, 1883. Habitat; North Carolina.
- americanus Forster. Nov. Spe. Ins. Cent. I, 100, 1771. Osten Sacken, Prodrôme II, 457. Habitat; eastern N. Am.
- limbatus* Palisot de Beauvois. Ins. 54, tab. 1, fig. 2, 1807.
- plumbeus* Drury. Ins. I, tab. 44, fig. 2.
- ruficornis* Fabricius. Syst. Ent. 789; Ent. Syst. IV, 365.
- annulatus Say. Jr. Acad. Phil. III, 32, 1823; Compl. Writ. II, 53. Osten Sacken, Supl. to Prodrôme 555. Habitat; Mo., Ky., Ga., Ks., La.
- astutus Osten Sacken. Prodrôme II, 471, 1876. Townsend Tr. Am. Ent. Soc. XXII, 57. Habitat; Me., N. H., N. Y., Conn.
- atratus Fabricius. Syst. Ent. 789, 1775; Ent. Sys. IV, 366. Bellardi, Saggio, Ditt. Mess. I, 58. Osten Sacken, Prodrôme II, 454. Habitat; eastern N. Am.
- niger* Palisot de Beauvois. Ins. Dipt., tab. 1, fig. 1.
- americanus* Drury. Ins. I, tab. 44, fig. 3.
- validus* Wiedeman. Auss. zwei. I, 113.
- baal Townsend. Tr. Am. Ent. Soc. XXII, 58, 1895. Habitat; Virginia.
- bicolor Wiedeman. Dipt. exot. I, 96, 1821; Auss. zweifl. Ins. I, 188. Osten Sacken, Prodrôme II, 460. Habitat; N. Y., Md., Pa., Ohio, Ills., Canada, N. J.
- ruficeps* Macquart. Dipt. Exot., Supl. 5, 35, 1855.
- fulvescens* Walker. List I, 171, 1848. Osten Sacken, Prodrôme II, 460; Catalogue 1878, 229.
- calens Linne. Syst. Nat. Ed. XII, II, 1000. Fabricius, Ent. syst. IV, 364. Habitat; N. America.
- californicus Martin. Can. Ent. XIV, 210. Habitat; California.
- captonis Martin. Can. Ent. XIV, 211, 1882. Habitat; California.
- carolinensis Macquart. Dipt. Exot. I, pt. 1, 145, 1838. Osten Sacken, Catalogue 1878, 226.
- centron Martin. Can. Ent. XIV, 211, 1882. Habitat; Colorado.
- cerastes Osten Sacken. Prodrôme I, 462, 1876. Habitat; Ky., Wis.
- hirtiocolatus* Macquart. Dipt. Exot. Supl. 5, 33, 1855. Osten Sacken, Catalogue 1878, 227.
- centron Marten. Can. Ent. XIV, 211, 1882. Habitat; Colorado.
- cinctus Fabricius. Ent. Syst. IV, 366, 1775. Osten Sacken, Prodrôme II, 464, 1876. Habitat; Atlantic States.
- cingulatus Macquart. Dipt. Exot. I, pt. 1, 144, 1838. Habitat; N. America.

coffeatus Macquart. Dipt. Exot. Supl. 2, 23, 1846. Osten Sacken, Prodrôme II, 441. Habitat; D. C., Del., N. Y., Fla., Mass., Ind., Fla., N. J.

(?) *nigripes* Wiedeman. Dipt. exot. 1, 75, 1821; Auss. zwei. I, 142. *comastes* Williston. Tr. Ks. Acad. X, 137, 1886. Townsend, Tr. Am. Ent. Soc. XXII, 58, 1895. Habitat; Wash., Or., Col., Col.

comes Walker. List IV, 1152. Habitat; N. Y., Hudson Bay.

inscitus Walker. List I, 172.

confusus Walker. List I, 147. Habitat; N. America.

conterminus Walker. Dipt. Saund. 24. Habitat; N. America.

costalis Wiedeman. Auss. zweif. Ins. I, 173, 1828. Osten Sacken, Prodrôme, II, 450. Habitat; eastern N. America.

baltimorensis Macquart. Dipt. exot. Supl. 5, 34, 1855.

vicarius Walker. List I, 187, 1848.

cymatophorus Osten Sacken. Prodrôme II, 444, 1876. Habitat; Ky.

derivatus Walker. List I, 151. Habitat; N. America.

dodgei Whitney. Can. Ent. XI, 37, 1879. Habitat; Kan., Neb.

dorsonotatus Macquart. Dipt. exot. Supl. 2, 22, 1846. Habitat; Carolina.

duplex Walker. List V, 173, 1854. Habitat; Hudson Bay Territory.

imitans Walker. List I, 173, 1848.

endymion Osten Sacken. Prodrôme Supl., 556, 1876. Habitat; Georgia.

epistatus Osten Sacken. Prodrôme Supl. 555, 1876. Habitat; Hudson Bay Territory, N. J.

socius Osten Sacken. Prodrôme II, 467.

exul Osten Sacken. Prodrôme Supl. 557, 1876. Townsend, Tr. Am. Ent. Soc. XXII, 60 (var?). Habitat; eastern U. S.

abdominalis Wiedeman (not Fabr.). Dipt. exot. I, 65; Auss. zweif. Ins. I, 116.

ferrugineus Palisot de Beauvois. Ins. 221, tab. 3, fig. 2.

flavipes Wiedeman. Auss. zweif. Ins. I, 137, 1828. Osten Sacken, Prodrôme II, 462. Habitat; Labrador.

fratellus Williston. Tr. Ks. Acad. X, 140, 1888. Habitat; Washington.

frenchii Martin. Can. Ent. XV, 111, 1883. Habitat; Montana.

fronto Osten Sacken. Prodrôme II, 431, 1876; Catalogue 1878, 228. Habitat; Car., Texas., Fla.

(?) *cheliopterus* Rondani. Nuovi. Annali. d. Sc. di. Bologna, 1850, 192. Osten Sacken, Prodrôme II, 473; Catalogue 1878, 228.

fulvofrater Walker. List I, 181, 1848. Habitat; Ills.

fulvulus Wiedeman. Auss. zweif. Ins. I, 153, 1828. Osten Sacken, Prodrôme II, 451. Habitat; Ky., Md., N. C., N. J.

fur Williston. Tr. Ks. Acad. Sci. X, 139, 1888. Habitat; Florida.

fuscipalpis Bigot. Mem. Soc. Zool. Fr. V, 681, 1892. Habitat; Wash.

fuscopunctatus Macquart. Dipt. exot. suppl. 4, 34, 1849. Osten Sacken, Prodrôme II, 432; Supl. 559; Catalogue 1878, 228. Habitat; S. Car., Ga., Fla.

imitans Walker. List I, 146, 1848.

giganteus DeGeer. Ins. VI, 226, tab. 30, fig. 1. Osten Sacken, Prodrôme II, 458. Habitat Middle States and South Atlantic States.

bicolor Macquart. Dipt. exot. suppl. 2, 21.

caesiofasciatus Macquart. Dipt. exot. suppl. 5, 32.

lineatus Fabricius. Spec. Ins. II, 455; Ent. Syst. IV, 363; Syst. Antl. 94.

gilanus Townsend. Psyche VIII, 92, 1897. Habitat; N. Mexico.

gracilis Wiedeman. Auss. zweif. Ins. I, 156, 1828. Osten Sacken, Catalogue 1878, 228. Williston, Tr. Ks. Acad. Sci. X, 140. Habitat; Ga., Fla.

- guttatulus Townsend. Tr. Ks. Acad. Sci. XIII, 134, 1892; Psyche VIII, 147. Habitat; Las Cruces, N. M.
- haemaphorus Marten. Can. Ent. XIV, 210, 1882. Habitat; California.
- hirtulus Bigot. Mem. Soc. Zool. Fr. V, 641, 1892. Habitat; Washington.
- illotus Osten Sacken. Prodrôme II, 469, 1876. Habitat; Canada.
- incisus Walker. Dipt. Saund. 26, 1856. Habitat; N. America.
- insuetus Osten Sacken. West. Dipt. 219, 1877. Habitat; California, Alaska, Wash., Col.
- intensivus Townsend. Psyche VIII, 93, 1897. Habitat; N. Mexico.
- intermedius Walker. List I, 173, 1848. Habitat; Hudson Bay Territory.
- lasiophthalmus Macquart. Dipt. exot. I, pt. 1, 143, 1838. Osten Sacken, Prodrôme II, 465. Habitat; eastern N. America, Columbia, Chile.
- notabilis* Walker. List I, 166, 1848.
- punctipennis* Macquart. Dipt. exot. Supl. 2, 23. Osten Sacken, Prodrôme II, 473.
- leucomelas Walker. List I, 175, 1848. Habitat; Georgia.
- leucophorus Bigot. Mem. Soc. Zool. Fr. V, 640, 1892. Habitat; Oregon.
- lineola Fabricius. Ent. Syst. IV, 369; Syst. Antl. 102. Osten Sacken, Prodrôme II, 448, 1876; Biol. Cent. Amer. I, 56. Habitat; eastern N. America.
- (?) *scutellaris* Walker. Dipt. Saund. 27, 1856.
- simulans* Walker. List I, 182, 1848.
- trilineatus* (Latr.?) Bellardi. Saggio Ditt. Mess. I, 63.
- longus Osten Sacken. Prodrôme II, 447, 1876; Supplement 559. Habitat; Ks., O., Ky., Fla., N. J.
- lugubris Macquart. Dipt. exot. I, pt. 1, 145, 1838. Osten Sacken, Prodrôme II, 456. Habitat; South Carolina.
- ater* Palisot de Beauvois. Ins. Dipt. tab. 2, fig. 5. Wiedeman, Dipt. exot. I, 74; Auss. zw. In. I, 136.
- maculifer Bigot. Mem. Soc. Zool. Fr. V, 641, 1892. Habitat; Wash.
- maculosus Coquillett. Jr. N. Y. Ent. Soc. X, 138, 1902. Habitat; Mexico.
- marginalis Fabricius. Syst. Antl. 99, 1805. Osten Sacken, Prodrôme II, 472. Habitat; N. America.
- maritimus Townsend. Ent. News IX, 167, 1898. Habitat; Texas.
- megerlei Wiedeman. Auss. zwei. Ins. I, 132. Osten Sacken, Prodrôme II, 457. Habitat; Florida.
- melanocerus Wiedeman. Auss. zwei. Ins. I, 122. Osten Sacken, Prodrôme II, 440. Habitat; Atlantic States from New Jersey south.
- (?) *exaestuans* Linne. Syst. Nat. Ed. XII, II, 1000. Degeer, Ins. VI, 229, tab. 30, fig. 5. Fabricius, Ent. Syst. IV, 365; Syst. Antl. 96. Osten Sacken, Prodrôme II, 441.
- melanorhinus Bigot. Mem. Soc. Zool. Fr. V, 642, 1892. Habitat; Wash.
- mexicanus Linne. Syst. Nat. Ed. XII, II, 1000. Fabricius, Spec. Ins. II, 457; Ent. Syst. IV, 367; Syst. Antl. 98. Wiedeman, Dipt. exot. I, 76; Auss. zwei. Ins. I, 147. Macquart, Dipt. exot. I, pt. 1, 143. Walker, List V, 215, 259. Bellardi, Sag. Ditt. Mess. I, 59. Osten Sacken, Prodrôme II, 459; Biol. Cent. Amer. I, 56. Habitat; southern U. S., Mexico, S. America, N. J.
- flavus* Macquart. Hist. Nat. Dipt. I, 200.
- inians* Fabricius. Ent. Syst. IV, 368.
- ochroleucus* Meigen. Syst. Besch. II, 62.
- olivaceus* Degeer. Ins. VI, 230, tab. 30, fig. 6.
- punctatus* Fabricius. Ent. Syst. IV, 368.
- sulphureus* Palisot de Beauvois. Ins. 222, tab. 3, fig. 6.
- viridiflavus* Walker. Newman Zoologist VIII, Append. LXVI.

- (var) *limonius* Townsend. An. Mag. Nat. Hist. Ser. VI, XX, 21. Habitat; Mexico.
- microcephalus* Osten Sacken. Prodrome II, 470, 1876. Habitat; N. H., N. Y., Me., N. J.
- molesus* Say. Jour. Ac. Phil. III, 31, 1823; Compl. Wri. II, 53. Wiedeman, Auss. zweif. Ins. I, 125. Osten Sacken, Prodrome II, 438. Habitat; Ky., D. C., Ga., Mo., N. C., Tenn., Ks., Fla., N. J.
- mutatus* Walker. Dipt. Saund. 23, 1856. Habitat; United States.
- nebulosus* Palisot de Beauvois. Ins. 222, tab. 3, fig. 4-5. Habitat; N. America.
- nigrescens* Palisot de Beauvois. Ins. 100, tab. 2, fig. 2. Wiedeman, Auss. zweif. Ins. I, 116. Osten Sacken, Prodrome II, 453. Habitat; Atlantic States.
- nigrovattatus* Macquart. Dipt. Exot. Suppl. 2, 24, 1846. Osten Sacken, Prodrome II, 449. Habitat; Atlantic States.
- nivosus* Osten Sacken. Prodrome II, 445, 1876. Habitat; N. J., N. Y., Ohio.
- novae-scotiae* Macquart. Dipt. Exot. Suppl. 2, 24, 1846. Habitat; N. America.
- ohioensis* Hine. Can. Ent. XXXIII, 28, 1901. Habitat; Ohio, Ind.
- pruinosis* Hine. Can. Ent. XXXII, 247, 1900.
- orion* Osten Sacken. Prodrome II, 442, 1876. van der Wulp, Tijdschr. v. Ent. XXIV, 158. Habitat; Canada, Mass., Conn. N. J.
- pallidus* Palisot de Beauvois. Ins. 100, tab. 2, fig. 3. Wiedeman, Auss. zweif. Ins. I, 118. Habitat; N. America.
- palpinus* Palisot de Beauvois. Ins. 221, tab. 3, fig. 1. Habitat; N. America.
- patulus* Walker. List I, 175, 1848.
- phaenops* Osten Sacken. West. Dipt. 217, 1877. Habitat; Cal., Col.
- politus* Johnson. Ent. News XI, 325. 1900. Habitat; N. J.
- procyon* Osten Sacken. West. Dipt. 216, 1877. Habitat; California.
- proximus* Walker. List I, 147, 1848. Habitat, Florida.
- psammophilus* Osten Sacken. Prodrome II, 445, 1876. Habitat; Florida.
- pumilus* Macquart. Dipt. Exot. I, pt. 1, 146, 1838. Osten Sacken, Prodrome II, 448. Habitat; Middle and Atlantic States.
- punctifer* Osten Sacken. Prodrome II, 453, 1876; West. Dipt. 220. Habitat; Western N. America.
- pygmaeus* Williston. Tr. Ks. Acad. Sci. X, 141, 1888. Habitat; Florida.
- recedens* Walker. List I, 147, 1848. Williston, Tr. Ks. Acad. Sc. X, 138. Habitat; Middle and south Atlantic states.
- catenatus* Osten Sacken. Prodrome II, 433, 1876; Catalogue 1878, 227.
- reinwardtii* Wiedeman. Auss. zweifl. Ins. I, 130. Osten Sacken. Prodrome II, 461. Habitat; Middle and Atlantic States, Canada, Kan.
- erythroletus* Walker. Dipt. Saund. 25, tab. 2, fig. 1.
- rhombicus* Osten Sacken. Prodrome II, 472, 1876; West. Dipt. 218. Habitat; Col., Wy., Or., Wash.
- rufofrater* Walker. Dipt. Saund. 26. Habitat; Georgia.
- rufus* Palisot de Beauvois. Ins. 100, tab. 2, fig. 1. Wiedeman, Auss. zweifl. Ins. I, 117. Osten Sacken, Prodrome II, 456; Supplement 559. Habitat; S. Car., Ga., Fla.
- fumipennis* Wiedeman. Auss. zweifl. Ins. I, 119.
- sagax* Osten Sacken. Prodrome II, 452, 1876. Habitat; Ills., Min., N. J.
- scitus* Walker. List I, 181. Habitat; N. America.
- septentrionalis* Loew. Verh. zool.-bot. Ges. VIII, 592. Osten Sacken, Prodrome II, 467. Habitat; Labrador, Alaska.

sequax Williston. Tr. Ks. Acad. Sci. X, 137, 1888. Habitat; Oregon.
sodalis Williston. Tr. Ks. Acad. Sci. X, 139, 1888. Habitat; N. America.

sonomensis Osten Sacken. West. Dipt. 216. Habitat; California, Alaska.
sparus Whitney. Can. Ent. XI, 38, 1879. Habitat; Fla., N. J., N. H., Conn., Mass.

stygius Say. Jr. Acad. Sc. Phil. III, 33, 1823; Compl. Writ. II, 54.
Wiedeman, Auss. zweifl. Ins. I, 131. Osten Sacken, Prodrôme II, 454. Habitat; Middle and Southern States.

sulcifrons Macquart. Dipt. Exot. Suppl. 5, 33, 1855. Osten Sacken, Catalogue 1878, 60 and 228. Habitat; Penn., N. J., Ohio, Ills.
tectus Osten Sacken. Prodrôme II, 436.

superjumentarius Whitney. Can. Ent. XI, 37, 1879. Habitat; N. H., N. J., Ohio.

susurrus Marten. Can. Ent. XV, 111, 1883. Habitat; Montana.

tener Osten Sacken. Prodrôme II, 440, 1876; Catalogue 1878, 60 and 228.
Habitat; Ga., Fla.

(?) *unicolor* Macquart. Dipt. Exot. Suppl. 2, 22.

tenessensis Bigot. Mem. Soc. Zool. Fr. V, 660, 1892. Habitat; Tenn.

tetricus Marten. Can. Ent. XV, 111, 1883. Habitat; Montana.

tetropsis Bigot. Mem. Soc. Zool. Fr. V, 681, 1892. Habitat; Georgia.

thoracicus Hine. Can. Ent. XXXII, 247, 1900. Habitat; New York.

trijunctus Walker. List V, 182, 1853. Osten Sacken. Prodrôme II, 432. Habitat; Florida.

trimaculatus Palisot de Beauvois. Ins. 56, tab. 1, fig. 5. Wiedeman, Auss. zweifl. Ins. I, 137; I, 132. Macquart, Dipt. Exot. I, pt. 1, 142. Osten Sacken, Prodrôme II, 439. Habitat; Middle and Southern States west to Kansas.

quinquelineatus Macquart. Hist. Nat. Dipt. I, 200.

trispilus Wiedeman. Auss. zweifl. Ins. I, 150. Osten Sacken, Prodrôme II, 464. Habitat; Northern and Middle States, Illinois, N. J.

turbidus Wiedeman. Auss. zweifl. Ins. I, 124. Osten Sacken, Prodrôme II, 430. Habitat; Ga., Ky., Fla.

(?) *fuscconervosus* Macquart. Dipt. Exot. I, pt. 1, 147.

variegatus Fabricius. Syst. Antl. 95. Wiedeman, Dipt. Exot. I, 67; Auss. zweifl. Ins. I, 120. Osten Sacken, Prodrôme II, 437. Habitat; Middle States.

venustus Osten Sacken. Prodrôme II, 444, 1876. Habitat; Tex., Ks., Ohio, Oklahoma.

vicinus Macquart. Dipt. Exot. I, pt. 1, 143. Habitat; Carolina.

villosulus Bigot. Mem. Soc. Zool. Fr. V, 684, 1892. Habitat; California.
vivax Osten Sacken. Prodrôme II, 446, 1876; Catalogue 1878, 60 and 228. Habitat; N. Y., Me., Ohio.

(?) *marginalis* Wiedeman. Auss. zweifl. Ins. I, 166.

wiedemanni Osten Sacken. Prodrôme II, 455; Supplement 559. Habitat; Fla., Ga., Ky.

ater Wiedeman. Auss. zweifl. Ins. I, 136.

zonalis Kirby. Fauna. Br. Am. IV, 314. Osten Sacken, Prodrôme II, 463; Catalogue 1878, 56 and 226. Townsend, Tr. Am. Ent. Soc. XXII, 58. Habitat; Northern States and Canada.

flavocinctus Bellardi. Saggio Ditt. Mess. I, 61. Osten Sacken, Catalogue 1878, 226.

tarandi Walker. List I, 156.

terrae-novae Macquart. Dipt. Exot. Suppl. 4, 35.

A SYSTEMATIC TREATISE OF OHIO SPECIES.

In the keys which are given below I have included a few species which have never been taken in Ohio, but in the descriptions only such species are considered as have been taken in the state and are deposited in the Ohio State University collection. Before attempting to use the keys one should acquaint himself with the meaning of terms as given below.

EXPLANATION OF TERMS.

- Antennae.* Always three segmented. Third segment compound, composed of from five to eight annuli or rings, bearing a prominent basal process in *Tabanus*. This process is absent or at least rudimentary in the other genera of our fauna.
- Apical-spot.* That part of the dark picture of the wing of *Chrysops* beyond the outer border of the cross-band, which term is explained below.
- Basal cells hyaline.* As this character is used in the key for the females of *Chrysops* some explanation is necessary. Those species which have slight infuscations at the base or apex of either of these cells are treated as having the basal cells hyaline, while those species with these cells infuscated far beyond the middle are placed in the other group. *C. montanus* has the most infuscation of any species placed in the former group, and *C. frigidus* the least of any placed in the latter.
- Color of eyes.* In life nearly all the species have highly colored bands or spots on the eyes. These are not distinguishable in dry specimens, but may be revived by moisture. However, this process usually destroys many other characters which it is desirable to retain.
- Cross-band.* The part of the dark picture of the wing of *Chrysops* beginning at the costa in the region of the stigma and proceeding backward, sometimes reaching and sometimes not reaching the posterior border of the wing.
- Empodium.* The plural form empodia is usually used. A pad or cushion located between the pulvilli at the distal end of each last tarsal segment.
- Eyes hairy.* This character is very plain in some species, but hard to see in others. It is always most easily seen in the males.
- Face.* The anterior surface of the head between the eyes and below the antennæ.
- Facial callosities.* Prominent elevations, one on either side of the face. They vary in coloration.

Front. The anterior surface of the head between the eyes and above the antennæ.

Frontal callosity. A prominence slightly above the antennæ, present in the female sex only. It varies in form and coloration.

Hyaline triangle. The hyaline patch beyond the outer border of the cross-band in Chrysops.

Ocelli. The simple eyes are present in many species and absent in others.

Ocelligerous tubercle. A prominence in some species of the genus *Tabanus* where the simple eyes would naturally occur. There are no simple eyes in our species of the genus.

Palpi. These are the only organs included under mouth parts not considered as belonging to the proboscis. They are prominent and vary in form and coloration.

Proboscis. The mouth parts other than the palpi taken collectively. The labium forms a sheath for the others.

Pulvilli. A pair of pads or cushions located one beneath each claw at the distal end of each last tarsal segment. Of the three pads seen in this location the two outer are pulvilli and the middle one is the empodium.

Stigma. A darker patch in the wing in the region of the union of the second vein with the costa.

Subcallus. The part of the front between the antennæ and the frontal callosity. It is denuded in some species. In others it is denuded in the female and pollinose in the male.

Tegulae. Two membranous lobes at the base of the wing. Shown in Plate II.

Wing. Reference to Plate II will give an understanding of the parts and regions of the wing.

FAMILY CHARACTERS.

The family *Tabanidæ* includes medium sized to large insects commonly called horseflies, gadflies, deerflies, dogflies, earflies and various other names. Usually its members are readily recognized at sight by their form and general appearance.

The three jointed antennæ with the third joint annulated and without a style or arista, the rather large tegula, and the well developed pulviform empodia taken together serve to distinguish them from other flies in case of any doubt.

None of the species are really small; the head is large, larger and hemispherical in the male, smaller and somewhat flattened in the female.

The antennæ are porrect and composed of three segments of which the third is compound, having five or eight annulations, when there are eight the basal one is only slightly longer than

the others, but when there are five the basal one is much longer than any of the others, often longer than all the others combined.

The eyes are separated in the female and contiguous in the male. They have an area of enlarged facets above in the latter sex, and in life are marked with green and purple markings in both sexes. In dry specimens these markings are lost, but may be partially restored by moisture. Ocelli are present in some species and absent in others; and the occiput is flat or concave. The proboscis projects and in some species is much elongated; the maxillary palps are large and two segmented.

The thorax and abdomen are clothed with more or less hair, but no spines or bristles. The wings are rather large and encompassed by the marginal vein, two submarginal and five posterior cells present, basal cell elongate, anal cell usually and sometimes some of the posterior cells closed. Tegulæ always prominent. Legs ample; pulvilli moderate; empodia developed pulviform; middle tibia with spurs at the tip.

Abdomen composed of seven visible segments, broad, never constricted.

Key to the North American Genera.

- | | |
|---|---------------------|
| 1. Hind tibiae with spurs at the tip, sometimes small | 2. |
| Hind tibiae without spurs | 6. |
| 2. Third segment of the antenna composed of eight annuli, the first of which is only a little longer than the following ones | 3. |
| Third segment of the antenna composed of only five annuli, the first of which is much longer than any of the following ones; ocelli present | 5. |
| 3. Front of female narrow; ocelli present or absent; fourth posterior cell at least open | <i>Pangonia.</i> |
| Front of female broad with a large denuded callus; ocelli present | 4. |
| 4. Eyes in the female acutely angulated above; wing in both sexes with a dark picture | <i>Goniops.</i> |
| Eyes in the female not acutely angulated above; wings hyaline in both sexes | <i>Apatolestes.</i> |
| 5. Second segment of the antenna about half as long as the first; eyes in life with numerous small dots | <i>Silvius.</i> |
| Second segment of the antenna as long or but little shorter than the first; wings with a dark picture | <i>Chrysops.</i> |
| 6. Third segment of the antenna without, or with a rudimentary basal process | 7. |
| Third segment of the antenna with a well developed basal process | <i>Tabanus.*</i> |
| 7. Front of female as broad as long the callus transverse | <i>Haematopota.</i> |
| Front of the female narrow | <i>Diachlorus.</i> |

* Including *Atylotus* and *Theriopectes*.

CHRYSOPS Meigen.

Illiger's Magazine II, 367, 1803.

The males and females in this genus are so different that it is often desirable to make observations in the field before associating the two sexes of a species. We have made a special effort to collect the sexes of our local species and have formulated separate keys for each sex. These keys are given below.

Key to the Females.

- | | |
|--|---------------------|
| 1. Apex of the wing beyond the cross-band is hyaline | 2. |
| Apical-spot present | 4. |
| 2. Both basal cells infuscated on their basal half | 3. |
| Second basal cell hyaline; face yellow in the middle | <i>niger.</i> |
| 3. Each side of the thorax with bright yellow hairs | <i>celer.</i> |
| Each side of the thorax with pale hairs | <i>carbonarius.</i> |
| 4. Whole body brown | 5. |
| Abdomen marked with pure black | 6. |
| 5. Basal segment of antenna swollen; abdomen above brown with small yellow triangles on the segments | <i>brunneus.</i> |
| Basal segment of antenna not swollen; abdomen above with darker designs | <i>flavidus.</i> |
| 6. Both basal cells hyaline | 7. |
| First basal cell altogether or to a considerable extent infuscated | 13. |
| 7. Apical-spot not wider than the distance between the costa and second vein at the outer border of the cross-band | 8. |
| Apical-spot wider than the distance between the costa and second vein at the outer border of the cross-band | 9. |
| 8. A black triangle encroaches upon the posterior part of the yellow on each side of the second abdominal segment | <i>moerens.</i> |
| No black triangle on each side of the second segment of the abdomen | <i>callidus.</i> |
| 9. The hyaline triangle is produced beyond the second longitudinal vein toward the costa | 10. |
| The hyaline triangle does not cross the second longitudinal vein | 12. |
| 10. Abdomen black with a middorsal stripe attenuated posteriorly and sometimes a shorter stripe on each side | <i>obsoletus.</i> |
| Abdomen yellow with two converging black spots on the second segment and black spots on the third and fourth | 11. |
| 11. The cross-band reaches the posterior margin | <i>fallax.</i> |
| The cross-band does not reach the posterior margin | <i>hilaris.</i> |
| 12. Apical-spot occupying only the apex of the second submarginal cell | <i>sackeni.</i> |
| Apical-spot occupying the anterior half of the second submarginal cell | <i>montanus.</i> |

13. Body altogether black; femora of all the legs dark brown or black *plangens.*
Body usually distinctly marked with yellow; femora yellow except sometimes at base 14.
14. Face black with a median stripe of yellow pollen *frigidus.*
Face yellowish in the middle 15.
15. Apical-spot large, reaching beyond the second submarginal cell, and invading the first posterior 16.
Apical-spot does not reach beyond the second submarginal cell 18.
16. The hyaline space between the cross-band and the apical-spot is confined to a small triangle in the second and third posterior cells *moechus.*
The hyaline triangle reaches across the first posterior cell 17.
17. Abdomen with a broad yellow longitudinal stripe in the middle enclosed between two black stripes *univittatus.*
Abdomen uniformly black or black with three dull yellow stripes *lugens.*
18. Abdomen yellow with four black stripes 19.
Abdomen black, yellow on the sides, and with yellow triangles on the segments *indus.*
19. Frontal callosity and scutellum yellowish *vittatus.*
Frontal callosity black; scutellum at base more or less blackish *striatus.*

Key to the Males.

1. Apex of the wing beyond the cross-band is hyaline 2.
Apical-spot present 4.
2. Face yellow in the middle *niger.*
Face wholly black 3.
3. Base of fifth posterior cell with a hyaline spot; anal cell nearly hyaline *carbonarius.*
Base of the fifth posterior cell uniformly brown; anal cell infuscated *celer.*
4. Whole body brown 5.
Body black or at least plainly marked with black 6.
5. First segment of antenna swollen; abdomen uniformly brown above, with a small triangle on each segment behind the first *brunneus.*
First segment of antenna not swollen; abdomen above lighter at base with a darker design on each segment behind the first *flavidus.*
6. Abdomen grayish black, or black with or without a median yellow stripe 7.
Abdomen at least yellow on the sides of the first two segments; or with a middorsal row of gray triangles 10.
7. Abdomen black with a middorsal yellow stripe 8.
Abdomen uniformly black 9.
8. The hyaline triangle produced forward to the costa *obsoletus.*
The hyaline triangle not produced beyond the second longitudinal vein *lugens.*
9. Hyaline triangle unusually small, confined to the apices of the second and third posterior cells *moechus.*
Hyaline triangle not unusually small; dark picture of the wing rather dim *plangens.*

10. Apical-spot not wider than the distance between the costa and second vein at the outer border of the cross-band 11.
Apical-spot wider than the distance between the costa and the second vein at the outer border of the cross-band 12.
11. The yellow on each side of the second segment encroached upon from behind by a black triangle; the yellow spot is very small *moerens*.
The yellow on each side of the second segment not encroached upon by a black triangle, or if so the triangle is very small *callidus*.
12. The hyaline triangle of the wing produced beyond the second longitudinal vein toward the costa 13.
The hyaline triangle not produced beyond the second longitudinal vein 14.
13. The cross-band of the wing reaches the posterior margin *fallax*.
The cross-band of the wing does not quite reach the posterior margin *hilaris*.
14. Abdomen with a middorsal row of large black spots widest before; facial callosities shining black *frigidus*.
Abdomen with a middorsal row of small gray or yellow triangles 15.
15. Abdomen with a middorsal yellow stripe 17.
Abdomen with a yellow stripe on either side of the black which contains the middorsal row of small triangles *montanus*.
Abdomen yellow on the sides of the first four segments but with no suggestion of stripes 16.
16. The cross-band occupies only the apex of the second submarginal cell *sackenii*.
The cross-band occupies the anterior half of the second submarginal cell *indus*.
17. Scutellum yellow *vittatus*.
Scutellum black 18.
18. Four black stripes on the dorsum of the first two abdominal segments; the inner of these may be united *striatus*.
Two black stripes on the dorsum of the first two abdominal segments *univittatus*.

CHRYSOPS BRUNNEUS n. sp.

Length 8-10 mm. Antennae noticeably longer and the first two segments thicker than in *flavidus*; first and second segments brown, third yellow at the base with apical half black; thorax with four grayish longitudinal stripes separated by brown intervals, the apical spot spreads over a large part of the apex of the wing fading out so gradually that the real extent of it is not clearly defined; a narrow whitish hyaline band is conspicuous along the distal margin of the cross band and occupies part of each of the first submarginal and first, second and third posterior cells; the cross-band fills out the fourth posterior cell and invades the fifth posterior; the margin of the posterior branch of the fifth vein spreads across the apex at the anal cell and communicates somewhat with the cross-band; the first basal cell is infuscated for two-thirds, and the second for about half the length.

The abdomen is clear brown often with very small yellowish triangles in the middle of the posterior part of segments two to five.

The male and female are alike, differing only in sexual characters.

Habitat: Sandusky, Ohio. Many specimens of both sexes.

The species is separated from *flavidus* by the following: The antennæ are longer and have the first two segments thicker and the third colored differently at base. The basal cells are more infuscated, the apical spot less clearly defined and the abdomen more uniformly colored. In *flavidus* the abdomen is distinctly lighter in color at base, but not so in *brunneus*. The former appears to be southern in its range, while the latter is probably northern.

Osten Sacken's description of the abdomen and apex of the wing under *flavidus* would seem to indicate that he had both species before him.

The species is abundant at Sandusky from the latter part of June to the first of August, and is an annoying pest in the vicinity of the marshes. It is abundant at any time of day, but appears to be most numerous and persistent in the evening, and its attacks are prolonged till almost dark in warm weather.

CHRYSOPS CALLIDUS Osten Sacken.

Length 7-9 mm. The width of the apical spot is equal to the distance between the costa and the second vein at the distal end of the first vein. First two segments of the abdomen yellow on the sides and this color on the second is not encroached upon by a black triangle. Basal half or more of the venter of the abdomen plainly yellowish but with a dark stripe or some dark spots on the mid ventral line.

Female: Frontal callosity black; facial callosity yellow; both basal cells hyaline; dorsally the abdominal segments with narrow, yellow hind margins which expand into triangles in the middle, none of these triangles extend forward far enough to entirely divide the black of any of the segments. Lateral margins of the segments behind the third black.

Male: Both basal cells with about the apical third hyaline; the yellow on the sides of the first two abdominal segments is more prominent and the posterior margins of all the segments wider than in the male of *moerens*.

Habitat: All parts of Ohio.

It is exceedingly common all over Ohio during the latter half of May and first half of June, and the females have often been observed attacking horses and cattle. The eggs are laid on foliage over water along the margins of ponds and canals; on a previous page in this paper we have described the eggs and the process of oviposition. The males have been taken on flowers and swept from vegetation growing near water. Although the species is most abundant during the months I have mentioned above, now and then a specimen is seen later, and last summer specimens were procured as late as August 28th, in the northern part of the state.

The hyaline basal cells in the female and the hyaline apical third of the same in the male, and the absence of the black triangle on the posterior margin of the side of the second segment in both sexes, serve to distinguish this species.

CHRYSOPS CELER Osten Sacken.

Length 8-10 mm. Whole body black, apex of the wing beyond the cross band clear hyaline.

Female: Base of antennae yellowish; sides of the thorax with a conspicuous tuft of yellow hairs in front of the wings; both basal cells of the wings brown on the basal three-fifths; cross band very nearly reaching the posterior margin filling out the fourth posterior cell with the exception of a very narrow apex; the fifth posterior cell is infuscated across its base but the apex is hyaline.

Male: Black including all the antennae and the hairs on the sides of the thorax; wing like that of the female except the anal cell is wholly infuscated, and the hyaline spot at the apex of each of the basal cells is shorter; these spots occupy the entire width of both cells.

Habitat: Has been taken in central and southern Ohio, and usually appears by May 15th.

The female is distinguished from all other species by the tufts of yellow hairs on the sides of the thorax. The male is distinguished from that of *niger* by the hyaline spots at the apex of the basal cells, occupying the whole width of these cells; and from that of *fugax* by the cross-band practically filling out the fourth posterior cell.

This is a common species in various parts of Ohio during the latter half of May. The eggs have been observed commonly along the margin of ponds and artificial lakes clinging to various kinds of foliage overhanging the water. The female has been observed ovipositing on different occasions, and is the only species of the genus observed placing its eggs in masses composed of layers one above the other as in *Tabanus*. Both sexes have often been taken from flowers, the females are annoying to stock, and persist in their attacks, and the male is occasionally found resting on foliage.

CHRYSOPS FALLAX Osten Sacken.

Length 6-8 mm. Face, palpi and base of antennae yellow, the hyaline triangle reaches the costa, separating the apical spot from the cross band; the cross band occupies nearly all of the space beyond a line from the apex of the first vein to the apex of the posterior branch of the third vein; the distal border of the cross band is quite regular and is marked by a slight curve from the costa just before the apex of the first vein to the apex of the anterior branch of the fifth vein; the fourth posterior cell is entirely filled out with brown, the posterior branch of the fifth vein is slightly margined with brown on both sides and both basal cells are hyaline.

Female: Facial callosity black; dorsally, abdominal segments black as follows: first with a spot beneath the scutellum, second with two narrow oblique spots, third and fourth each with four nearly square spots, the others entirely black except the narrow yellow posterior margin; ventrally, abdomen yellow basally, marked with black on apical half.

Male: Abdominal spots on the second segment united anteriorly, spots on third and fourth segments small.

Habitat: Medina, Sandusky, Wauseon.

The markings on the abdomen are somewhat variable, and the male has a slight infuscation at the base of each of the basal cells. The two sexes are so near alike that they are easily associated.

The separation of the apical spot from the cross-band distinguishes it from all species except *hilaris*, and *fallax* is noticeably smaller than that species.

The black marking beneath the scutellum is single in *fallax* and divided in *hilaris*.

CHRYSOPS FLAVIDUS Wiedemann.

Length 7-10 mm. First two segments of antennae yellowish, not noticeably thickened; basal part of third segment yellowish with an obscure brown band on its thickest part, apical half black; the thorax has four grayish longitudinal stripes separated by brown intervals; the parts of the wing not occupied by brown are grayish hyaline and not clear as in most species; the hyaline triangle reaches forward to the middle of the first submarginal cell and includes about half of the second submarginal and parts of the first three posterior cells; the cross band fills out the fourth posterior cell; the apex of the anal and part of the fifth posterior are infuscated; usually the apical half of the first basal cell and two-thirds of the second basal are hyaline but some variation is allowable; dorsally the abdomen is brownish, lighter on the first segment and sides of second, and segments two, three and four have a prominent gray triangle in the middle of the posterior part preceded by a dark area which usually takes the form of a geminate spot; the anterior margins of the last three segments are black or brown; the dark markings of the abdomen are somewhat variable.

The male and female are alike, except in the single male I have fully half of the second basal cell is brown.

Habitat: Taken at Cincinnati, Ohio, by Charles Dury.

Regarding the synonymy I am inclined to the belief that *flavidus*, *pallidus* and *canifrons* refer to the species here considered as *flavidus*, for Wiedemann's type came from Florida, Bellardi's from Mexico, and Walker's from Georgia. Besides, they all mention the dark markings on the abdomen.

CHRYSOPS FRIGIDUS Osten Sacken.

Length 6-8 mm. Facial callosities shining black with a stripe of yellow pollen between them, palpi yellow; first basal cell of the wing brown on basal three-fifths and at apex, second basal brown on basal half and at extreme apex, cross band not quite reaching the posterior

margin, posterior branch of the fifth vein margined with brown which color spreads across the apex of the anal cell and also unites with the cross band across a large part of the fifth posterior cell, the apical spot unites with the cross band in the marginal and first submarginal cells and entirely fills them out with brown and extends into the anterior part of the second submarginal.

Female: The facial callosities black produced forward and inward and meeting above the mouth, frontal callosity shining black; first two segments of the abdomen broadly yellow on the sides, first segment dorsally with a large black spot beneath the scutellum, second with a black spot which is variable in different specimens, in some it is smaller and confined to the anterior half of the segment, while in others it is larger, widened anteriorly, and may unite with the black of the third segment, a transverse spot on anterior part of third segment occupying nearly its whole width, last three segments black with yellow hind margins, ventrally abdomen yellow with small black spots in the middle of some or all the first four segments, last three segments blackish with yellow hind margins.

Male: Abdomen, dorsally, yellow on the side of the first four segments, middle of each of these segments with a large black spot which is widest before and which does not reach the posterior margin of its segment except on the first where it is confluent posteriorly with the black of the second, last three segments black with yellow hind margins, ventrally, like the female except the black markings are larger than in that sex.

Habitat: Sandusky, Ohio.

Chrysops frigidus is the only North American species of its genus so far described with an apical spot and with the face entirely black in ground color. In other species of its group the ground color above the mouth is yellow. In this particular it agrees with *C. celer* and other members of the group without an apical spot.

CHRYSOPS INDUS Osten Sacken.

Length 7-9 mm. The apical spot fills out the marginal and first submarginal cells, and extends into the second submarginal along the apical three-fourths of the anterior branch of the third vein.

Female: Frontal callosity black, face, palpi and base of antennae yellow; first basal cell of the wing brown except a small patch in the apical third; abdominal segments one to four and oftentimes five and six yellow on the sides; yellow triangles on the middle of the third and following segments produced forward and dividing the black of these segments into two parts, thus a middorsal line is formed composed of a series of triangles; there is a conspicuous triangle on the second segment but it does not extend forward to the anterior margin of that segment.

Male: Much darker in color than the female; usually the first basal cell is entirely filled out with brown, but in all specimens I have seen there is a small hyaline patch at the apex of the second submarginal cell and in some specimens a very small hyaline patch is present in the apical third of the first submarginal; anal cell entirely infuscated; abdominal segments one to four narrowly margined with yellowish on the sides; posterior margins of the segments behind the second narrowly but plainly yellow, and second and following segments with very small yellow triangles; abdomen otherwise clear black. This sex is here described for the first time.

Habitat: Taken in Central Ohio. It appears usually by the middle of May.

This species is one of the first to appear in the spring, and females have been observed ovipositing on plants growing along the margin of a small lake on the University grounds. Males have been taken near where the females were ovipositing and on flowers of *Cornus*. The eggs are placed in single layers on grass blades that hang out over the edge of the water.

CHRYSOPS LUGENS Wiedemann.

Length 8-9 mm. First segment of the antennae yellow, second variable but usually yellow, third black, face yellow, its lateral callosities black; the hyaline triangle of the wing does not cross the second longitudinal vein; the apical spot includes nearly all of the second submarginal and the apex of the first posterior cells, so that the triangle is narrow and may be said to be lunate; the abdomen is wholly black above or marked on the basal part with three yellow longitudinal stripes.

Female: Frontal callosity black; thorax dorsally with two greenish gray stripes, narrowly separated by brown, first basal cell brown, second hyaline; the cross band fills out the fourth posterior cell; posterior branch of the fifth vein obscurely margined.

Male: Medium stripes of the thorax more yellow than in the female, second basal, fifth posterior, and anal cells largely infuscated; to the unaided eye a subhyaline streak is visible beginning at the margin of the wing and passing the length of the fifth submarginal cell into the second basal and thence toward but not attaining the base of the cell; this sex is much like the female and easily associated with it.

Habitat: Taken at Medina, Ohio.

CHRYSOPS MOECHUS Osten Sacken.

Length 8 mm. Hyaline triangle of the wing very small occupying only part of the second and third posterior cells.

Female: Face, palpi and base of antennae yellow, frontal callosity black; first basal cell of wing infuscated, second hyaline except a margin along the vein which separates it from the first, the cross band reaches the posterior margin filling out the fourth posterior cell; in the fifth posterior cell there is a margin along the posterior intercallary vein and also along the posterior branch of the fifth; the apex of the anal cell is slightly infuscated; dorsally the markings of the abdomen are variable but four longitudinal rows of dark spots are usually visible.

Male: Face yellow, otherwise whole body including most of the wings black; the only trace of hyaline in the basal cells is a dot on the fourth vein near the base of the discal cell.

Habitat: Common all over Ohio.

The very small hyaline triangle serves to distinguish this species from others, and also to associate the sexes which are strikingly different in coloration.

I have observed the females ovipositing on foliage overhanging a mill race at Georgesville, Ohio, June 4, 1899.

CHRYSOPS MOERENS Walker.

Length 8 to 11 mm. A dark colored species, sides of first two abdominal segments narrowly marked with yellow, that on the second segment encroached upon from behind by a small black triangle. Wings beyond the crossband with a very narrow brown border along the costa; under side of abdomen uniformly black, or at most with suggestions of yellowish in patches.

Female: Frontal callosity black, shining, facial callosity yellow, shining; wings with base, costal cells and crossband, which does not reach the posterior margin, brown or nearly black; the brown margin along the costa beyond the crossband is so narrow as to be nearly obsolete, both basal cells hyaline; the abdominal segments, both dorsally and ventrally are gray margined behind and dorsally these margins expand into triangles in the middle of the segments.

Male: Darker colored than the female, a small patch only hyaline at apex of each of the basal cells; posterior margins and triangles of the abdominal segments less plainly marked than in the female; the yellow on sides of the first two abdominal segments variable, that on second segment present in all my specimens and quite constant, but it is oftentimes lacking altogether on the first segment; this sex usually somewhat smaller than the female.

Habitat: Northern Ohio.

The species is a very common and annoying one at Sandusky through July. The females bite severely and persist in following our small boats through the marshes, and the hotter the sun the more active the flies. The females oviposit on various kinds of foliage in the marshes, oftentimes several rods from shore, where the water is four feet in depth or more. The eggs are deposited in a single layer, and a short time after deposition become pure shining black in color. Just how the young from masses of eggs deposited in such deep water grow to maturity and emerge as adults I have not been able to observe; of course some masses of eggs are deposited very near the shore. The males have been taken in large numbers by sweeping in grass near shore, and on various kinds of flowers which grow in the vicinity. This is the first mention of the male of this species, I have seen in print.

The large size, the abdomen black ventrally and the very narrow costal margin beyond the cross-band in both sexes easily distinguishes this species from others of its group.

CHRYSOPS MONTANUS Osten Sacken.

Length 7-8 mm. Face, palpi and base of antennae yellow; the hyaline triangle does not cross the second longitudinal vein but in the majority of specimens reaches entirely to it; the apical spot covers about one half of the second submarginal cell.

Female: Frontal callosity black; first basal cell of wing infuscated on basal third and on the narrowed part at apex; second basal cell hyaline except a slight infuscation at extreme base; the cross band attains the posterior margin entirely filling out the fourth posterior cell; the posterior

branch of the fifth vein is plainly margined on both sides with brown and this margin communicates more or less with the cross band across the fifth posterior cell; the first abdominal segment has a rather obscure dark patch beneath the scutellum, the second has two elongate oblique black spots connate anteriorly, and sometimes on either side near the posterior margin a very small additional spot; the third and fourth each have four black spots, and in some specimens five has likewise, but usually five, six and seven are uniformly black on the whole anterior part; all the segments behind the first are narrowly margined with yellow; ventrally, abdomen yellow with apex and narrow lines on the sides of some of the segments blackish.

Male: Both basal cells infuscated except a small hyaline patch at the apex of each; the first segment of the abdomen is blackish with the exception of a yellow posterior margin which is slightly expanded on either side, the second has a large quadrate black spot in the middle enclosing a small yellow triangle posteriorly and on each side a narrow longitudinal spot also black; three and four are colored like two; the segments behind the second are plainly margined posteriorly with yellow and five, six and seven are uniformly black in front. These markings form a wide longitudinal black stripe in the middle of the abdomen enclosing small yellow triangles on segments two to four, and on each side of this a much narrower black stripe followed by a still narrower black stripe. Hitherto this sex has not been described.

Habitat: Northern and Southern Ohio.

I have never found the species common except at Cincinnati in the region of a series of small artificial lakes. Here the females were very persistent in attacking me, and I procured males by sweeping the plants that grew along the edge of one of the lakes.

CHRYSOPS NIGER Macquart.

Length 6-8 mm. First segment of antennae yellow, face yellow with cheeks and facial callosities black; body and legs except the metatarsi and part of the following segment on the middle and posterior pairs, black; apex of wings beyond the cross band hyaline.

Female: First basal cell of wing brown except a small spot near the apex bordering the fourth longitudinal vein, second basal hyaline; the cross band nearly fills out the fourth posterior cell but does not enter the fifth posterior; the very narrow hyaline apex of the fourth posterior cell varies slightly in width in different specimens.

Male: Colored like the female except only a small spot at apex of the second basal cell is hyaline, and the fifth posterior, except at extreme base, and anal cells are dimly infuscated.

Habitat: A common species in Ohio and one of the earliest to appear in spring.

The entirely hyaline second basal cell distinguishes the female of this species from all others of its group. The small size of the hyaline spots in the apex of the basal cells are characteristic of the male. The hyaline spot of the first basal is very small and borders the fourth vein.

Different specimens of this species taken in the same locality are quite constant, but there appears to be considerable variation in the amount of infuscation of the first basal cell when specimens from different sections are compared. Specimens from the southern part of its range seem to show the most hyaline in this cell.

Common in May and June in all parts of the state. The females are often observed on horses and cattle.

CHRYSOPS OBSOLETUS Wiedemann.

Length 7-8 mm. Basal segments of antennae yellow, second and third segments usually black although the second is sometimes yellowish; face yellow, its lateral callosities black; thorax above with two medium greenish gray stripes narrowly separated by brown, the hyaline triangle of the wing crosses the second longitudinal vein and in most specimens reaches the costa; the apical spot is confined to the distal parts of the marginal and first and second submarginal cells, the cross band nearly fills out the fourth posterior cell leaving only an obsolete margin at its apex.

Female: Frontal callosity black, both basal cells hyaline; dorsally, abdomen black with a yellow middorsal stripe on the first four segments; variations occur in which an additional yellow stripe is present on either side of the middorsal one, and in some specimens the first two segments are narrowly yellow on the sides.

Male: Several specimens of this sex have the first basal cell infuscated and the abdomen black above with the single middorsal yellow stripe; otherwise like the female.

Habitat: Common all over Ohio.

This is a common species in woods where the females are an annoying pest. I have taken numbers of the males by sweeping along the margins of artificial lakes.

CHRYSOPS SACKENI n. sp.

Length 8-10 mm. Abdominal segments one to four yellow on the sides; apical spot where it joins the cross band equal in width to the marginal cell plus one-fourth of the first submarginal at the same place.

Female: Frontal callosity yellowish on the disk, and black on the margin; annulate portion of third antennal segment black, remainder of antennae, face and palpi yellow; first basal cell infuscated at base for about one-third its length, and at apex on the narrowed portion; second basal cell with a much shorter infuscation at base and scarcely any at apex; cross band abbreviated behind, the fourth posterior cell not filled out with brown; the cloud on the last section of the fifth vein spreads practically across the anal cell and communicates with the cross band across the base of the fifth posterior cell; dorsally, abdominal segments three to six with distinct posterior yellow margins which expand into prominent triangles in the middle; second segment with a prominent triangle but not margined behind; none of the triangles reach the anterior margins of their respective segments; ventrally, abdomen yellow with a mid ventral row of black spots and on each side two narrow black stripes; dorsally, the black on the second segment is composed of two oblique spots connate at the anterior third and attaining both margins.

Male: First basal cell with a hyaline patch before the apex; second basal cell with a long hyaline streak through its center; this streak is expanded near the apex of the cell and communicates with the hyaline patch in the first basal; the veins which bound the anal cell are margined with brown; the yellow on the sides of the first two abdominal segments is less extensive than in the female and the yellow triangles are smaller.

Habitat: Sandusky, Ohio.

The width of the apical spot easily separates this species from *moerens*, *callidus* and *indus*. It is related to *pudicus*, but is more robust, the black on the second segment is more extensive and the cross-band different than in that species. Osten Sacken probably included it with *pudicus*. See his observation appended to that species.

It appears to be a common species on Cedar Point during the first half of June, and the females were very persistent in attacking us while we were collecting the specimens we procured.

CHRYSOPS STRIATUS Osten Sacken

Length 7-9 mm. The two longitudinal stripes on the middle of the thorax are "greenish-gray" and therefore quite different from those of *vittatus*; abdomen, dorsally marked with four longitudinal stripes, the two inner of which usually reach the scutellum and join one another on the first segment and in now and then a specimen they also unite on the anterior part of the second segment; the outer stripes may or may not reach forward onto the first segment; ventrally yellow on basal half, marked with black on middle and sides on apical half.

Female: Frontal callosity varying from light brown to pure black; scutellum black on the disk, margined with yellow; first basal cell of wing brown, second hyaline except a small patch at base; the cross band leaves a very narrow margin at the apex of the fourth submarginal cell; posterior branch of the fifth vein dimly margined on both sides, otherwise the fifth posterior and apical cells are hyaline; the hyaline triangle occupies the apical parts of the first three posterior cells and extends into both submarginal cells in the region of the branching of the third vein; the second submarginal is almost entirely brown in some specimens or in others may be hyaline along the whole length of the posterior branch of the third vein to the extent of half the cell.

Male: Scutellum usually entirely black; a subhyaline streak passes from the margin of the wing lengthwise of the fifth posterior cell into the second basal and toward the base of the wing along the fourth vein; otherwise the second basal and fifth posterior cells infuscated, first basal brown with the exception of a small hyaline spot; apical spot includes nearly all of the second submarginal and may encroach upon the first posterior cell. The male is here described for the first time.

Habitat: Sandusky, Ohio, where it is fairly common.

This species is variable and hard to define; the variations extend to characters which in other species are known to be constant, and in some instances suggest a close relationship with *sequax*, whose type locality is Western Kansas.

CHRYSOPS UNIVITTATUS Macquart.

Length 6-8 mm. Basal segment of antennae yellow, second a little darker and third nearly black; hyaline triangle of the wing reaches or nearly reaches the second vein; the apical spot is large, occupying all the marginal cell beyond the cross band, the broad apex of the first submarginal; all the second submarginal except a small patch at base and the apex of the first posterior; the cross band entirely fills out the fourth posterior cell.

Female: Frontal callosity black, face yellow, its lateral callosities brown or black; first basal cell brown; second basal cell with a very little brown at base; posterior branch of the fifth vein narrowly margined with brown, abdomen with a middorsal yellow, longitudinal stripe with a black stripe of about the same width on either side of it; outside the black stripes the abdomen may be entirely yellow, or all but the first two segments may be dull black, or there may be a narrower black stripe beginning on the third segment and continuing onto the fourth and fifth segments; the last three abdominal segments are often blackish obscuring all stripes in that region.

Male: Second basal cell of wing brown on its basal two-thirds and the fifth posterior more brown than in the female; last three segments of the abdomen black, first four with a middorsal yellow stripe, on each side of which is a wider black one; and outside of the latter on segments three and four is an additional narrow black stripe. The three specimens of this sex I have present no variations. It looks much like the female and is easily associated with it.

Habitat: A common species in June in all parts of the state. The males have been taken on various flowers.

CHRYSOPS VITTATUS Wiedemann.

Length 8-9 mm. Face, palpi and base of antennae yellow; thorax dorsally with four bright yellow longitudinal stripes with brown intervals separating them; scutellum yellow; hyaline triangle of the wing rather small occupying the apical part of the first three posterior cells and extending into the first and second submarginal in the region of the branching of the third vein; a hyaline streak in the second submarginal cell usually follows the posterior branch of the third vein toward the margin of the wing but does not reach this margin.

Female: Frontal callosity yellow; first basal cell of wing brown, second slightly infuscated at base, otherwise hyaline, cross band very nearly attains the posterior margin; the fourth posterior cell except narrow apex, fifth posterior except at base and narrow apex and anal at apex brown, abdomen dorsally with four longitudinal black stripes; the two inner are pale on the first segment and the two outer on the first and second segments; ventrally yellow, darkened at apex, and on either side with two narrow dark lines abbreviated before.

Male: Like the female except the second basal cell of the wing has only the apical third hyaline.

Habitat: Found in all sections of Ohio.

This species is not likely to be confused with others of our fauna except *striatus*, and from this it may be distinguished by the yellow thoracic stripes, and yellow scutellum in both sexes.

The most abundant and widespread species in this section. The females are troublesome to stock, and are commonly observed on horses and cattle with their abdomens filled with blood. The males have been procured along the margin of ponds and on various kinds of flowers.

PANGONIA Latreille.

Hist. Nat. des Crust. et des Ins. III, 1802.

Only a single species of this genus has been taken in Ohio up to the present time. Two others have a range such that they may be considered as probably belonging to our fauna. These three are considered in the key below. The males and females are so much alike that a single key will serve for both sexes.

Key to the species.

- | | |
|---|--------------------|
| 1. Antennae dark | 2. |
| Antennae light reddish or yellow | <i>pigra.</i> |
| 2. Hind borders of the abdominal segments with gray hairs | <i>rasa.</i> |
| Hind borders of the abdominal segments with golden-yellow hairs | <i>tranquilla.</i> |

PANGONIA RASA Loew.

Length 11-13 mm. A brownish species with the hind margins of the abdominal segments white; femora light brown, tibiae and tarsi darker; first two segments of the antennae brown with black hairs, third segment nearly black; wings pure hyaline with brown stigma.

Female: Thorax distinctly gray with three darker longitudinal vittae; abdominal segments with distinct gray margins which in some cases expand into median triangles, most distinct on the second segment; proboscis slightly longer than the height of the head nearly black in color; maxillary palps yellowish, the terminal segment pointing downward and slightly forward, half as long as the proboscis.

Male: General color darker than in the female, the posterior margins of the abdominal segments narrower and consequently less prominent than in the female and with no trace of a median triangle on any of the segments; proboscis about as long as the height of the head, palpi darker than in the female with the terminal segment pointing almost directly forward.

Habitat: Northern and Southern Ohio.

I have taken both male and female on flowers, but have never observed the female around stock.

CONIOPS Aldrich.

Psyche VI, 236, 1892.

There is only one species in this genus. So far as our species of this group are concerned, the genus appears to be sufficiently characterized, but a full knowledge of Central and South American forms is necessary before conclusive results can be reached in the sub-family.

GONIOPS CHRYSOCOMA Osten Sacken.

Length 12-14 mm. Abdomen short and wide; legs pale; wings hyaline at base and on part of posterior margin, otherwise dark almost black in fully matured specimens.

Female: Body entirely pale yellowish although some specimens show a brownish tinge on dorsum of thorax and abdomen, posterior margins of abdominal segments clothed with silvery white hair; face and front wide, eyes small, and pointed above, a line along the inner side of each from the most inferior to the most superior points is very nearly a straight line; proboscis much shorter than the head, palpi nearly as long as the proboscis.

Male: Thorax black above with two narrow longitudinal stripes, abdomen black with a tinge of reddish on the sides and with narrow posterior margins to the segments; clothed with pale yellowish pile.

Habitat: Northern and Southern Ohio.

I have taken both sexes of this species from foliage, but have not observed the female around stock. The peculiar dark markings on the wings of both sexes and the form of the eyes and wide front in the female will serve to distinguish this species from all others of the family in our fauna.

TABANUS Linne.

Fauna Suecica, 1761.

In this genus the markings of the abdomen are much used for distinguishing species. The term gray markings as used in the key below refer to the rows of triangles and to the stripes, and not to the gray margins of the various segments. The males and females of the same species in this genus are very much alike in coloration, so it does not appear necessary to construct a separate key for each sex.

Key to the species.

- | | |
|---|-------------------|
| 1. Eyes bare | 2. |
| Eyes pilose | 16. |
| 2. Abdomen with definite gray markings | 3. |
| Abdomen not with definite gray markings | 13. |
| 3. The gray markings of the abdomen consist of a single longitudinal row of triangles | 4. |
| The gray markings of the abdomen consist of three longitudinal rows of triangles or spots | 9. |
| The gray markings consist of a middorsal stripe running from the scutellum to the end of the abdomen, and usually an additional stripe on each side | 12. |
| 4. Wing uniformly hyaline, but the stigma brown | <i>coffeatus.</i> |
| Wing smoky on basal part or with distinct spots of brown, at least along the cross veins and bifurcation of the third vein | 5. |
| 5. Wing with distinct brown patches other than along the cross veins and the bifurcation of the third vein | <i>venustus.</i> |
| Wing without distinct brown except along the margins of the cross veins and bifurcation of the third vein | 6. |

6. Prevailing color of the abdomen black 7.
- Prevailing color of the abdomen reddish brown 8.
7. Segments two to five with small gray triangles *superjumentarius*.
- Segments three to five with large gray triangles, no triangle
on the second segment *trimaculatus*.
8. Abdominal segments two to five with medium sized gray
triangles, wing of female whitish on the disk, all the
facets of the eyes of the male of nearly the same size *variegatus*.
- Abdominal segments two to five with large gray triangles,
wing of the female not whitish on the disk, large and
small facets of the eyes of the male distinctly differen-
tiated *sulcifrons*.
9. The gray spots on the sides of the abdominal segments are
small and do not touch the hind margin 10.
- The gray spots on the sides of the abdominal segments are
large and touch the hind margin 11.
10. Third antennal segment long and narrow, prevailing color
of the abdomen reddish brown *longus*.
- Third antennal segment rather short and wide, prevailing
color of the abdomen black *pumilus*.
11. Gray stripes on the thorax plainly reaching the scutellum *vivax*.
- Gray stripes on the thorax obsolete behind *nivosus*.
12. Thorax uniformly yellowish pollinose, costal cells yellow *costalis*.
- Thorax dark colored with gray stripes, costal cells hyaline *lincola*.
13. Whole body including the wings black *atratus*.
- Whole body including the wings not black 14.
14. Abdomen black, wings brownish with a darker spot at the
bifurcation of the third vein *stygius*.
- Abdomen brownish, no dark spot at the bifurcation of the
third vein 15.
15. Wings hyaline except the costal cells which are brown *americanus*.
- Wings uniformly brownish *giganteus*.
16. Cross veins and bifurcation of the third vein margined with
brown 17.
- Cross veins and bifurcation of the third vein not margined
with brown 18.
17. Rather large, grayish species, abdomen not distinctly reddish
on the sides *reinwardtii*.
- Medium sized, abdomen broadly reddish on the sides *lasiophthalmus*.
18. Third antennal segment deeply excised making the basal pro-
cess long, general color chocolate brown *cerastes*.
- Third antennal segment not deeply excised 19.
19. Medium sized species, ocelligerous tubercle present 20.
- Rather small species, no ocelligerous tubercle 21.
20. Abdomen broadly and distinctly reddish on the sides *epistatus*.
- Abdomen narrowly or obsoletely reddish on the sides *carolinensis*.
21. Prevailing color of the whole body bright yellowish *bicolor*.
- Prevailing color of the thorax and abdomen black, thinly
dusted with grayish pollen *ohioensis*.

TABANUS ATRATUS Fabricius.

Length 16-28 mm. The male and female of this common species are easily associated as they differ only in sexual characteristics. The whole insect is uniformly black and the thorax and abdomen in well preserved specimens are thinly covered with a whitish dust which is easily rubbed off when specimens are not properly cared for.

It cannot be confused with any species recorded from Ohio but the smaller specimens resemble *wiedemanni* very closely. The wider front, the longer basal process of the third antennal segment, and the shape of the frontal callosity, which is square in *wiedemanni* and wider than high in *atratus*, are distinctive characters. Its much larger size and less shining color distinguish it from *lugubris*.

Habitat: Common all over Ohio.

Never numerous enough to be a particularly striking pest, but specimens have been taken in every month from June to September, so that it is one of the species one may expect to see at any time during the summer. The eggs are deposited around marshy places on grasses and sedges, and the larvæ are to be found by digging in the mud. Larvæ are easily kept in confinement for months, and feed on various invertebrate forms. Fish-worms seem to suit them well, and they have no hesitation in eating their own species, therefore, in rearing each larva must have a separate cage. In one instance where I placed a larva in the same cage with a pupa it was not long before the former bored through the covering of the latter and began feeding upon the soft inner parts. The larvæ push through the soil in all directions in search of food, and the earth in the breeding cage where an active larva is confined usually proves that it is capable of finding everything that will sustain life before giving up in despair.

TABANUS BICOLOR Macquart.

Length 10-13 mm. Whole insect bright yellowish but thorax and a rather wide middorsal stripe on the abdomen darker than the other parts. Eyes pilose but no ocelligerous tubercle present in either sex. Antennæ, palpi, proboscis and legs yellow, dorsum of thorax including the scutellum brown in ground color but uniformly covered with yellow pollen; wings hyaline with yellowish veins; middorsal stripe of the abdomen brown, also covered with yellow pollen, usually widest on the first segment and gradually narrowing to the end of the abdomen or sometimes slightly widened again on the last two or three segments. The male and female are marked alike, but in the latter sex there is a tendency for the dark color of the abdomen to be more diffuse with limits not plainly apparent.

Habitat: Sandusky and Danville.

The bright yellowish color of this species is characteristic. It has not been observed annoying stock. Most of my specimens were taken by sweeping in grasses in marshy places.

TABANUS CAROLINENSIS Macquart.

Length 12-15 mm. Eyes pilose; a small ocelligerous tubercle present, palpi pale, antenna reddish, annulate portion of the third segment black or in some specimens the black of the antenna is more extensive, including a large part of the third segment and the superior angles of the first and second segments. Thorax black with obsolete gray stripes, thinly gray pollinose, and clothed, especially on the sides, with gray pile; wings hyaline with base and costal cells pale yellowish, veins brown; legs reddish brown, tarsi and apices of all the tibiae darker; abdomen above brown, lighter colored on the sides, each segment with a gray hind margin which expands into a small triangle at the middle.

Female: Subcallus denuded, shining brown or blackish, communicating with the frontal callosity which is rather small and separated from a linear denuded spot above it by a pollinose interval; vertex in the region of the ocelligerous tubercle denuded, shining brown. Eyes pilose, but this is rather difficult to see if not aided by a strong lense.

Male: Subcallus not denuded; eyes plainly but short pilose; head not noticeably larger than in the female.

Habitat: Ironton, Cincinnati, Newark and Medina.

The abdominal markings are variable and therefore hard to describe. The change from reddish to black is very often so gradual that it is hard to say where the one color ends and the other begins. The gray posterior margins of the segments are very narrow, and the middorsal row of triangles very small. The denuded subcallus of the female in conjunction with the hyaline wings is sufficient to separate it from related Ohio species. It is close to rhombicus of the western states.

TABANUS CERASTES Osten Sacken.

Length 14-16 mm. Eyes pilose, palpi pale, first two segments of the antenna reddish with black hairs; third segment with a very prominent basal process, apex of this process and annulate portion black, remainder reddish; thorax brown with five rather prominent gray stripes, scutellum uniform brown; the vestiture of the thorax and scutellum give a grayish appearance; wings hyaline, veins brown and costal cell smoky; legs brownish with the tarsi and apical part of all the tibiae darker. Abdomen above dark brown, with a middorsal row of gray triangles, a row of prominent gray spots on each side, and gray posterior margin on each segment.

Female: Frontal callosity shining brown and nearly square, as wide as the front, and with an elongate denuded spot above it; sides of the front parallel.

Male: Head noticeably larger than in the female, but the coloration does not differ from that sex.

Habitat: Hanging Rock, on the Ohio River, May 29, resting on foliage.

This species is very much like some others with pilose eyes, but both sexes are readily distinguished by the very prominent basal process on the third segment of the antenna.

TABANUS COSTALIS Wiedemann.

Length 12-14 mm. Palpi yellowish, antennae brownish with the annulate portion darker; thorax including the scutellum uniformly grayish yellow pollinose; legs largely black, base of front tibiae and the middle and hind tibiae except at apex yellowish; wings hyaline with the costal cells yellowish, veins yellowish; abdomen above alternately striped with black and grayish yellow.

Female: Frontal callosity black, above with a very much narrowed prolongation the part of which adjacent to the callosity is sometimes obliterated leaving the upper part as a separate spot.

Male: This sex is much like the female and easily associated with it, but there is a tendency toward obliteration of the distinct markings of the abdomen, the black of the female is replaced by brownish and the stripes may blend so that the whole base of the abdomen is practically one color.

Habitat: Common all over Ohio.

This species may be confused with *nigrovittatus*, *sagax* and *fulvulus*, all of which have the yellowish costal cells. The last two are usually larger than *costalis*, and the spots on the sides of the abdomen above are not contiguous; the former has the apex of the third tibia reddish, while *costalis* has the same part black. So far *nigrovittatus* is known from the Atlantic coast only.

The green-headed fly, as *costalis* is called, is one of our worst stock pests. It is most abundant during August, when a large number of other annoying flies are numerous.

TABANUS EPISTATUS Osten Sacken.

Length 14-16 mm. Eyes pilose, ocelligerous tubercle present; thorax black with rather prominent gray stripes; wing hyaline with extreme base, costal cells, and veins brownish, abdomen broadly reddish on the sides.

Female: Subcallus often although not always denuded; palpi distinctly thickened and rather short, front gradually widened above, frontal callosity small, shining brown, rounded above, and separated from a linear shining spot above it by a pollinose interval. Legs brown, femora lighter than the other parts.

Male: Subcallus not denuded in the specimens before me, head rather small, eyes distinctly pilose; palpi short and thick.

Habitat: Sandusky; taken in the tall grass on the border of a marsh July 6th.

This species is very close to *affinis*, but easily separated from it by the enlarged palpi. The palpi in *affinis* are long and slender.

The color of the abdomen is variable, in some specimens there is a distinct black middorsal stripe, but in others this stripe is more or less broken up by the encroachment of the reddish.

TABANUS GIGANTEUS Degeer.

Length 22-25 mm. Palpi pale, antennae reddish; thorax reddish brown with some darker stripes, and thinly clothed with gray pollen, scutellum dark at base reddish at apex, wings uniformly reddish brown, legs reddish with tarsi darker than the other parts; abdomen above dark brown, approaching black with gray hind margins to the segments.

Female: Front quite narrow, yellowish pollinose; frontal callosity shining brown, not quite as wide as the front below, gradually narrowed on upper half and extending above into a linear prolongation which reaches more than half way to the vertex.

Male: Colored like the female, head rather small; eyes composed of large and small facets but the difference in size not so great as in most other species.

Habitat: Wauseon, London, Newark and Cincinnati.

The species occurs late in the season, and I have never found it abundant, though it appears to be widely distributed. Its color and large size easily separate it from all North American species except *americanus*, and that species has hyaline wings with the costal cell dark brown.

TABANUS LASIOPHTHALMUS Macquart.

Length 13-15 mm. Eyes pilose, ocelligerous tubercle present, thorax black with narrow gray stripes which are not prominent; wings hyaline, cross veins and bifurcation of the third vein margined with brown. Abdomen broadly reddish on the sides.

Female: Subcallus denuded, shining black; frontal callosity also shining black, as wide as the front, and separated from a denuded spot above by a pollinose interval; front slightly widened above.

Male: Subcallus not denuded, eyes very plainly pilose, head about equal in size to that of the female.

Habitat: Common in all parts of the state from May 15 to June 15.

Very easily recognized by its pilose eyes in connection with the denuded subcallus and brown margins to the cross veins and bifurcation of the third vein.

TABANUS LINEOLA Fabricius.

Length 12-15 mm. Palpi white, antennae reddish, annulate portion of third segment darker; thorax brown and gray striped, the latter color not prominent; wings hyaline; legs reddish, apex of the front tibia plainly, apex of middle and hind tibiae faintly, and all of the tarsi dark brown; abdomen above brown or black with three prominent, gray stripes.

The males and females of this species are easily associated. In the latter sex there is sometimes a confusion of colors; the dark is replaced by reddish but the gray middorsal stripe is always prominent in all well preserved specimens.

Habitat: Common all over Ohio.

This and *costalis* are near together in size, but the hyaline costal cell and gray striped thorax distinguish *lineola*. It is an annoying pest during the first part of the summer.

TABANUS LONGUS Osten Sacken.

Length 14-15 mm. General color brownish; form somewhat elongate; palpi white with short hairs, part of which appear black; antennae reddish, third segment black on apical part; thorax brownish with faint grayish stripes, wings hyaline, legs brownish, tibiae especially the last four segments darker; abdomen above brown with narrow, gray hind borders to the segments; a row of faint elongate spots on the middorsal line, these form a continuous row and therefore take on the appearance of a stripe, each of the first five or six segments of the abdomen have on either side a small somewhat oblique spot which does not touch either margin.

Female: Front slightly wider above, clothed with grayish yellow pollen; frontal callosity nearly square, dark brown, and either united or separated from a shining spot which lies above it and which appears to be the upper part of the linear prolongation seen in many species.

Male: Like the female except in sexual characteristics.

Habitat: Medina, Ohio, where it is common and often observed on horses.

TABANUS NIVOSUS Osten Sacken.

Length 12-14 mm. Palpi pale yellow, antennae black, five narrow gray stripes on the anterior part of the thorax, these are obsolete behind, wings hyaline with brown veins, legs black, tibiae more or less reddish; abdominal segments above with very narrow gray hind borders which expand into small gray triangles in the middle, prominent gray markings on the sides of the segments, these markings get smaller gradually from before backwards, and outwardly from them on each side is a row of black spots which vary in size in different specimens.

Female: Sides of the front parallel, frontal callosity brown, nearly as wide as the front, and above with a linear prolongation which reaches half way to the vertex.

Male: The two sexes are easily associated but the male usually has most gray on the abdomen.

Habitat: Sandusky, where it is common.

This species resembles *vivar* somewhat, but the pale yellow palpi in both sexes, the parallel sides to the front in the female and the lack of prominent gray stripes on the thorax are characteristic of *nivosus*. It appears to be partial to stagnant water, while *vivar* breeds in swift flowing streams. It is one of the Ohio species which readily attacks man, and is somewhat of an annoyance at the bathing beach, following out over the water as far as one is pleased to go.

TABANUS OHIOENSIS Hine.

Length 10 mm. Opaque black, eyes pilose, legs pale except the bases of all the femora which are black; whole body clothed with rather long gray hairs and a thin dusting of grayish pollen.

Female: Front and face very pale yellowish pollinose, palpi pale, antennae yellow; frontal callosity and ocelligerous tubercles wanting, wings hyaline with pale yellowish veins, abdomen with just a trace of red on the sides of the first two segments, otherwise dark and the gray hairs on the posterior border of each segment above gives the appearance of the segments being margined with gray posteriorly.

Male: Abdomen plainly red on the sides of the first three segments; otherwise colored as in the female.

Habitat: Columbus, Danville and Medina.

This species belongs to the same group with *bicolor* and *thoracicus*, but its much darker color serves to recognize it readily. Like *bicolor* it frequents marshy places, and is most readily procured by sweeping in grasses growing in such places.

TABANUS PUMILUS Macquart.

Length 8-10 mm. First segment of the antennae and annulate portion of the third black, thorax black with distinct gray stripes, wings hyaline; abdomen above black with narrow gray margins to the segments, a middorsal row of gray triangles, each in connection with the posterior margin of its segment, and on either side of this row of triangles a row of small nearly round gray spots none of which touch either margin of the segments.

Female: Front distinctly wider above, frontal callosity shining black, nearly square and occupying nearly the whole width of the front. Abdomen sometimes reddish on the sides.

Male: Head large, the division between large and small facets well marked and there is a striking difference in the size of the facets. The abdomen in some specimens has a suggestion of reddish on the sides.

Habitat: Medina, Danville and Cincinnati.

In appearance very much like *fratellus* of the Northwest, and *sparus* described from New Hampshire. In the latter species the gray spots on the sides of the abdomen above are larger, and on the second and third segments are broadly contiguous with the hind margin. The third antennal segment is noticeably narrowed in *fratellus*, while in *pumilus* it is wide with a distinct basal process.

In the field this species has habits much like a *Chrysops* for it persists in its attacks on the collector. Specimens are easily taken with the net at such times. It is often observed annoying horses and cattle.

TABANUS REINWARDTII Weidemann.

Length 14-19 mm. Eyes pilose, palpi pale yellowish, antennae black, sometimes first segment reddish; thorax brownish, thickly clothed with rather long gray hairs, above with white stripes; legs largely dark colored but the basal part of all the tibiae yellowish, this color is least extensive on the anterior pair; wings hyaline with the cross veins and bifurcation of the third vein margined with brown; abdomen with a middorsal row of prominent gray triangles and on either side of this a row of oblique gray spots which connect with the narrow gray hind margins of the segments.

Female: Frontal callosity shining black, scarcely as wide as the front, slightly higher than wide and with a linear prolongation above; sides of the front parallel.

Male: Thorax more thickly pilose than in the female, head only slightly larger, eyes very distinctly pilose.

Habitat: Cincinnati and Medina.

TABANUS STYGIUS Say.

Length 20-22 mm. Third segment of the antennae red at base, blackish at apex, first and second segments and palpi dark; legs black, often the tibiae reddish at base; wings yellowish brown with the posterior border approaching hyaline, a brown spot on the bifurcation of the third vein, also the transverse vein closing the discal cell margined with brownish; abdomen uniform black.

Female: Thorax dorsally plainly whitish pollinose with more intense longitudinal lines.

Male: Thorax dorsally uniform grayish brown in well preserved specimens.

Habitat: Sandusky, Wauseon and Cincinnati.

It is closely related to *nigrescens*, but in the specimens before me the wings have more color on the anterior part than in that species. In *nigrescens* the dorsum of the thorax is shining black, thinly whitish pollinose on anterior fourth in both sexes, therefore the difference in color in this region is distinctive when dealing with perfect specimens. However, the males are very close at best, and easily confused.

It resembles *punctifer* somewhat, but this species has the front tibia white on basal third and the thorax uniformly white in both sexes.

The females oviposit on *Sagittaria* growing in shallow water at Sandusky, and on a previous page I have fully described this process.

TABANUS SULCIFRONS Macquart.

Length 18-21 mm. Palpi brownish, antennae nearly black with the third segment brownish at base; legs dark, bases of tibiae darker; wings with a distinct brownish tinge, cross veins at the end of the discal cell and bifurcation of the third vein margined with brown.

Female: Front with parallel sides, frontal callosity shining brown, not quite as wide as the front, nearly square and with a linear prolongation above. Segments of the abdomen above with prominent gray, hind margins which expand into large gray triangles in the middle; usually a black mark on the anterior part of each of the second and third segments at the apex of the gray triangle.

Male: The division between the large and small facets of the eye prominent; head slightly more convex than in the female but nearly of the same size, coloration of the whole body the same as in the female.

Habitat: Common in all parts of Ohio in August.

This species is very near *exul* and *abdominalis*, neither of which have been recognized from this state, although it is within their range. The large, gray, abdominal triangles are characteristic of *sulcifrons*. In *abdominalis* the first posterior cell is closed, and the front in the female is noticeably narrowed. In *exul* the head of the male is sub-hemispherical and the abdominal triangles are moderate. Regarding its relationship with *variegatus* see under that species below.

In certain parts of Ohio this species is so abundant that it is one of the worst of stock pests.

TABANUS SUPERJUMENTARIUS Whitney.

Length 16-20 mm. This species resembles *trimaculatus* in many respects but the following differences may be noted: the legs are uniformly black or at least dark with occasionally a suggestion of reddish at the bases of the tibiae; the wings are uniformly subhyaline with no darker margins to the cross veins and bifurcation of the third vein; dorsally, abdominal segments two, three, four and five each with a very small white triangle in connection with the middle of the posterior margin; ventrally, there is not the contrast between the colors of the median and lateral areas exhibited in *trimaculatus*.

The male and female are colored alike except in the specimens before me the thorax is not so distinctly white in the former as in the latter.

Habitat: Akron and Cincinnati.

TABANUS TRIMACULATUS Palisot de Beauvois.

Length 16-19 mm. Antennae dark, nearly black, palpi yellowish; thorax dorsally with whitish pollinose stripes and brownish intervals, scutellum uniformly whitish pollinose; legs black except base of all the tibiae which are white; wings hyaline, costal cell brown, bifurcation of the third vein, cross veins and sections of veins that have a transverse direction margined with brown; abdomen dorsally black with a large white triangle in connection with the middle of the posterior margin of each of segments three, four and five; abdomen ventrally white on the sides and a wide black median stripe.

The male and female differ only in sexual characteristics.

Habitat: All sections of the state during the latter part of May and the first half of June. Occasionally as late as July first.

The three prominent triangular white markings of the abdomen easily distinguish this species.

TABANUS VARIEGATUS Fabricius.

Length 20-23 mm. This species is much like *sulcifrons*, but the gray triangles in the middle of the abdominal segments are smaller than in that species and the disk of the wings, at least in the female, have a suggestion of whitish.

Female: Gray triangles of the abdomen prominent, those on the second and third and sometimes the fourth segments preceded by a black mark, a blackish marking at the lateral margin of each abdominal segment and last two or three segments largely dark.

Male: What is most probably the male of this species as it was taken in the same locality with the females may be described as follows: colored much like the female and therefore much like *sulcifrons*, but the middorsal row of triangles are very small and preceded by black markings on the second, third and fourth segments; cross veins at the apex of the discal cell, and the bifurcation of the third vein narrowly margined with brown; the facets of the eyes nearly uniform in size, those on the disk of the eye are slightly larger than at the margin but the difference is no where near as striking as in the male of *sulcifrons*.

Habitat: Central Ohio.

TABANUS VENUSTUS Osten Sacken.

Length 13-15 mm. Antennae and palpi brownish, thorax with white stripes and brown intervals, scutellum uniformly whitish pollinose; wings variegated with brown and hyaline as follows: base hyaline as far out as the humeral cross vein, beyond this a brown band extending from costa to posterior margin and occupying about half of the anal cell, then follows a shorter band partially confluent with the former and surrounding the cross veins which close the basal cells, the brown apex of the marginal cell is confluent across the first submarginal with the prominent brown spot at the bifurcation of the third vein, the transverse veins closing the discal cell are broadly margined and a lighter brown space follows the posterior border of the wing to its apex where it unites with the darker brown in that region.

Female: The posterior margins of the abdominal segments above are gray and expand into prominent triangles in the middle of segments two, three and four. In the middle of the venter is a wide brown stripe bordered on each side by lighter.

Male: This sex is like the other except the dorsal markings of the abdominal segments are expanded laterally and give the appearance of wide posterior margins.

Habitat: Cincinnati, Ohio, June 25.

Taken by Mr. Charles Dury, who has donated a male and female to the University collection.

This is the only species of *Tabanus* in our fauna with the wings variegated on basal half.

TABANUS VIVAX Osten Sacken.

Length 14-16 mm. Slightly elongate, antennae black, first segment partially reddish especially in the female, face clothed with gray hairs and pollen, the latter having a yellowish tinge; thorax with five gray stripes separated by black, scutellum uniformly black with gray hairs on the

posterior margin and with darker hairs on the basal part, wings hyaline, legs somewhat variable but inclined to black with the basal part of the tibiae yellow, abdomen with a prominent middorsal row of gray triangles and gray spots on each side.

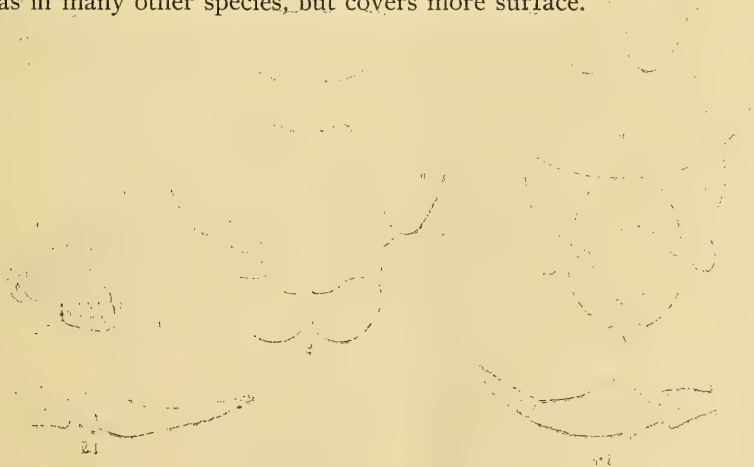
Female: Palpi light yellow front noticeably gradually widened above, frontal callosity below nearly as wide as the front, about square, above with a narrowed extension which reaches half way to the vertex; segments of the abdomen above with gray posterior margins which expand into prominent triangles in the middle; first two segments nearly uniform gray on the sides, next three segments with extensive gray markings enclosing a black patch on the anterior part of the segments, last three segments largely black on the sides; the black on the second segment takes the form of two spots connected before and produced laterally so as to include the anterior margin of the segment; on the following three segments the black takes the form of four spots, the middle two of which are united before.

Male: Antennae black, palpi darker than in the female, and the legs may be said to be uniform black except that the bases of all the tibiae are pale; abdomen with more gray than in the other sex but the arrangement is the same.

Habitat: Oxford, Georgesville, Loudonville and Medina.

The two sexes are easily associated. The species may be confused with *nivosus*, *coffeatus*, *longus* and some of the species with hairy eyes, but these latter need not enter into the case if care is exercised. From *longus* its uniform black instead of reddish color is distinctive, *coffeatus* has only the posterior margins of the segments white on the sides, and a reference to the description of *nivosus* above will reveal the difference between *vivax* and that species.

The larvæ live in streams, and the females have been observed ovipositing on stones in ripples. The egg mass is not so convex as in many other species, but covers more surface.



FIGS. 21, 22, 23, 24. TABANID LARVÆ.

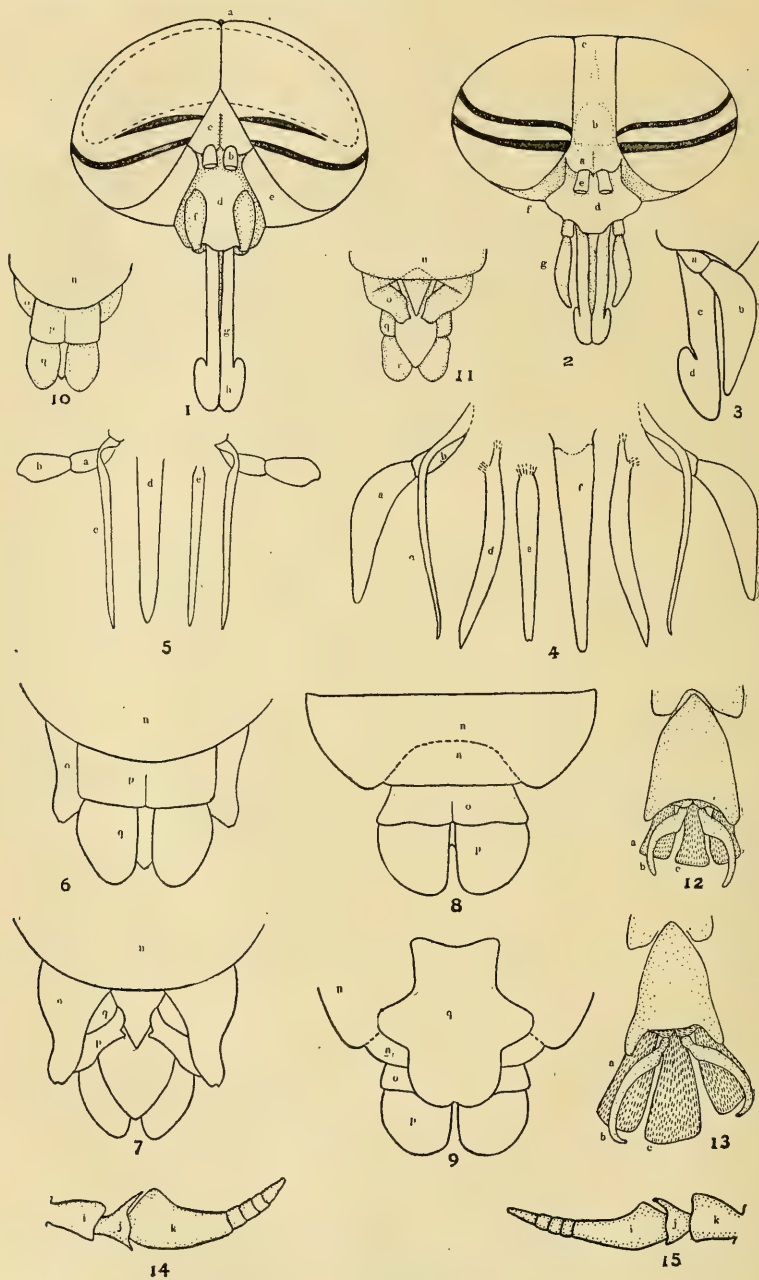


PLATE I.

All the figures were taken from *Tabanus sulcifrons*.

Fig. 1. Anterior of head of male. The greater part of this view is occupied by the compound eyes on the surface of which are to be seen the transverse green bands which are represented by heavy black lines. The space included within the dotted lines represents the location of the enlarged facets. a, vertical triangle; b, first segment of one of the antennae; c, frontal triangle, a plus c form the front; d and e, face, e, cheek; f, one of the maxillary palpi; g, proboscis; h, labella.

Fig. 2. Anterior view of head of female. c, front which includes all the space down as far as the base of the antennae; b, frontal callosity with linear extension above; a, subcallus; d, f, face, f, cheek; e, basal segment of antennae; g, maxillary palpus.

Fig. 3. Side view of proboscis and maxillary palpus of female. c, proboscis; d, labella; a, basal segment; b, apical segment of a maxillary palpus.

Fig. 4. Mouth parts of female. a, apical segment; b, basal segment of maxillary palpus; c, maxilla; d, mandibles; e, hypopharynx; f, labrum.

Fig. 5. Mouth parts of male. a, b, maxillary palpus; c, maxilla; d, labrum; e, hypopharynx.

Fig. 6. Dorsal view of segments 8, 9, 10 of the male abdomen. n, p, q, segments 8, 9, 10, respectively; o, basal segment of clasper.

Fig. 7. Ventral view of Fig. 6. n, q, r, segments 8, 9, 10 respectively; o, p, segments 1 and 2 of claspers respectively.

Fig. 8. n, o, p, dorsal view of segments 8, 9, 10 of female abdomen respectively.

Fig. 9. Ventral view of Fig. 8. q, infraanal plate.

Fig. 10. Same as Fig. 6, showing different position of male claspers.

Fig. 11. Same as Fig. 7, showing different position of claspers. The second segment of the claspers is folded under the first.

Fig. 12. Last segment of female front tarsus. a, pulvillus; b, claw; c, empodium.

Fig. 13. Last segment of male front tarsus lettered as in Fig. 12.

Fig. 14. Female antenna. i, j, k, segments 1, 2, 3 respectively. The third segment is prominent at base and composed of five annulations, the basal one of which is longer than the others combined.

Fig. 15. Male antenna.



HINE on "Tabanidæ of Ohio."

PLATE II.

I, II, III, IV, V, VI, first, second, third, fourth, fifth, sixth longitudinal veins respectively; VII, costa or costal vein; VIII, auxiliary vein; IX, transverse shoulder vein; X, small cross-vein; XI, posterior cross-vein; XII, anterior branch of the third vein; XIII, posterior branch of the third vein; XIV, anterior intercalary vein; XV, anterior branch of the fifth vein; XVI, posterior intercalary vein; XVII, anterior basal transverse vein; XVIII, posterior branch of the fifth vein.

a, b, c, first, second and third costal cells respectively, or costal cell; d, marginal cell; e, f, first and second submarginal cells respectively; g, h, i, j, k, first, second, third, fourth and fifth posterior cells respectively; l, discal cell; m, n, first and second basal cells respectively; o, anal cell; p, axillary cell.

1, anal angle; 2, alula; 3, antitegula; 4, tegula; 5, axillary incision.

The drawing is taken from the wing of *Tabanus Stygius* Say.

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OHIO STATE
ACADEMY OF SCIENCE

Special Papers No. 6

The Birds of Ohio

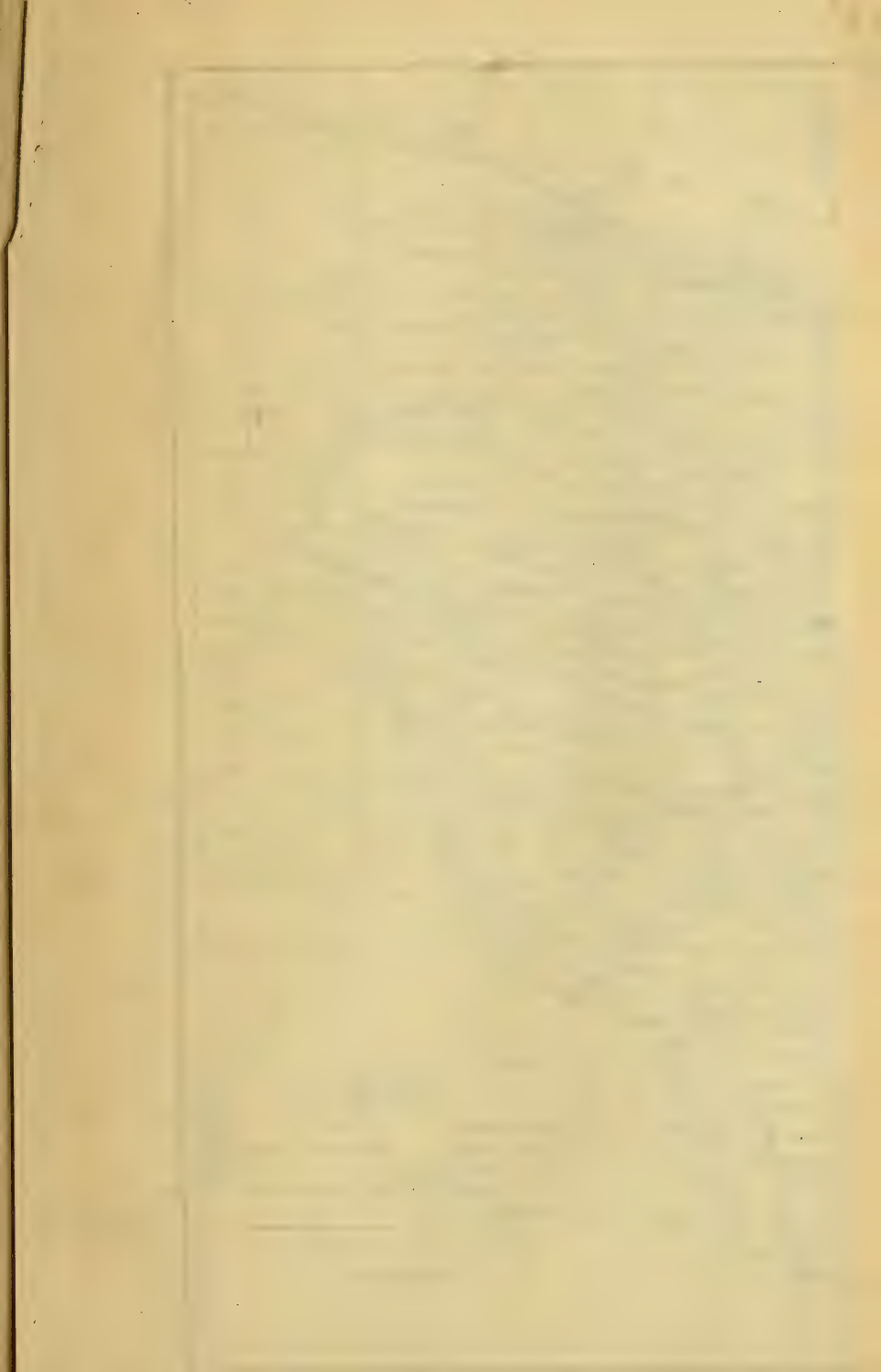
A REVISED CATALOGUE

BY

LYNDS JONES, M. Sc.

Published by the Academy of Science with the
Emerson McMillin Research Fund

OCTOBER, 1903





County Seats

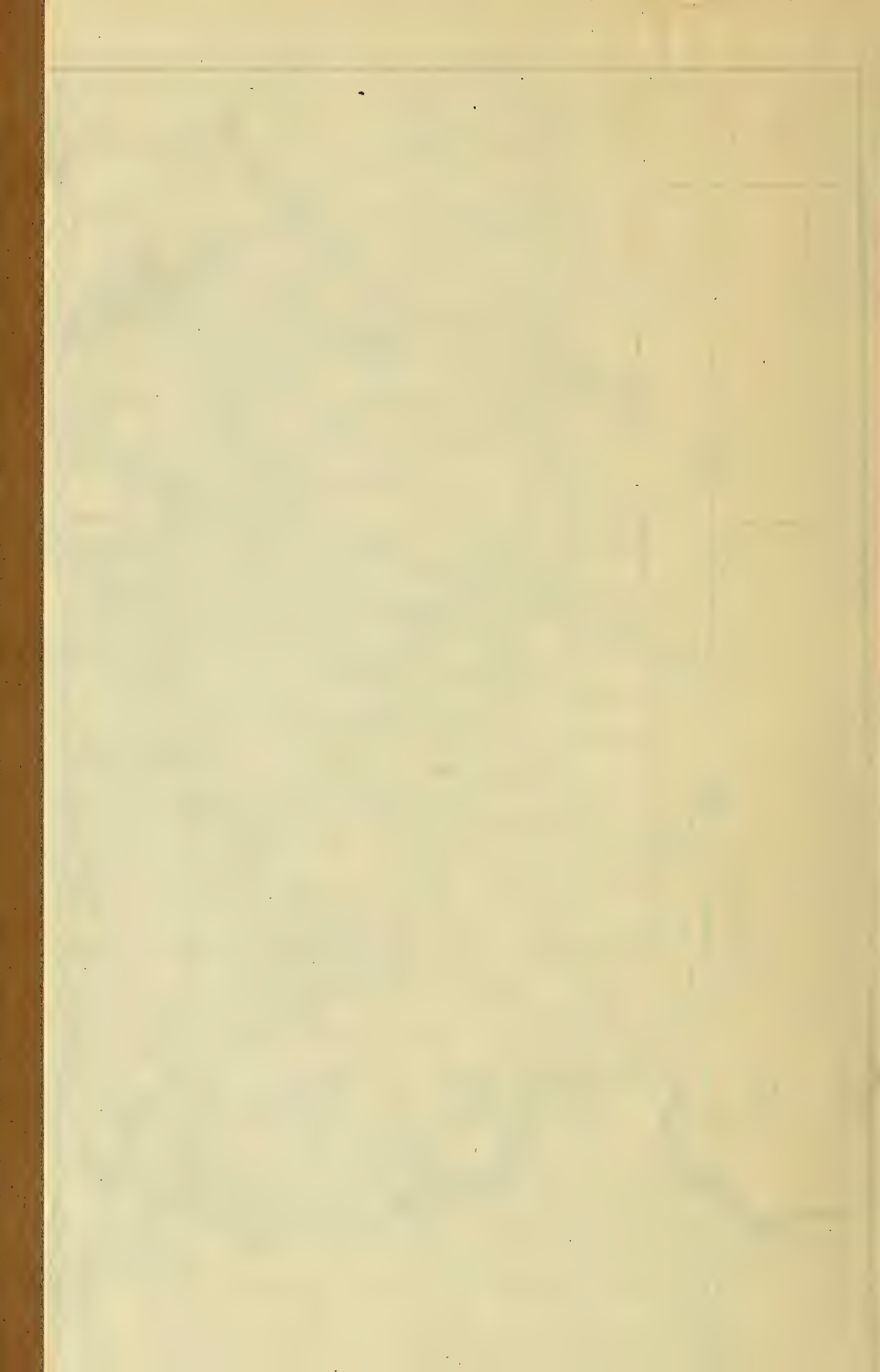
Glacial boundary

Contour lines 500 and
1000 feet above tide

Alleghenian life zone
boundary line

0 5 10 20 30 40 50

Scale of miles



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Publication Committee :

J. H. SCHAFFNER, L. H. MCFADDEN, GERARD FOWKE

OCTOBER 15, 1903

NOTE.

The study upon which this paper is based was carried on under two grants of thirty-five and seventy-five dollars each from the Emerson McMillin Research Fund, and the expense of publication is met by the further aid of the same fund.

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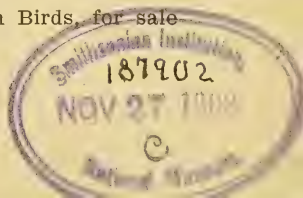
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PREFACE.

Dr. J. M. Wheaton transmitted his monumental "Report on the Birds of Ohio" to Prof. J. S. Newberry, Chief Geologist of Ohio, on November 1, 1879. It was finally printed by the state and distributed in 1882. One year later, at the first Congress of American Ornithologists' Union, held in New York, September 26-29, 1883, a committee was appointed to whom was referred the question of revising the classification and nomenclature of the Birds of North America. That committee's work was completed, accepted, and the results printed in a Check-List* early in 1886. Until the publication of this Check-List there had been no uniformity in the nomenclature of birds, each author practically building his own system. Dr. Wheaton adopted, in a somewhat modified form, "The nomenclature of Dr. (Elliot E.) Coues in his Check-List of North American Birds," published in 1874. That system followed the customs of the time by beginning with the highest and ending with the lowest forms. The nomenclature adopted by the committee of the American Ornithologists' Union* turned the old system about, beginning with the lowest and ending with the highest forms, as they were then regarded. Seven years after the completion of his work and four years after its publication, therefore, the nomenclature of Dr. Wheaton became obsolete, for the new nomenclature found immediate acceptance the country over, and has since been the working basis of all American Ornithologists.

The need of a Revised Catalogue of the Birds of Ohio has been sorely felt, chiefly that the nomenclature might be uniform with that of all more recent publications on Ornithology. The score of years which have elapsed since Dr. Wheaton's Catalogue was issued have seen other changes

*The A. O. U. Check-List of North American Birds, for sale by L. S. Foster, 30 Pine street, New York City.



as well as those of nomenclature, making the call for a revision all the more imperative. The changes in the physical features incident to the fuller settlement of the state have been attended by changes in the whole fauna, the bird population changing with the rest.

Keenly feeling the need for a state catalogue of our birds which should embody the latest results of field work and conform to the adopted system of nomenclature, the writer appealed to the Ohio State Academy of Science, at its meeting in December, 1900, and found ready sympathy in the plan for a revision. A liberal portion of the McMillin fund was placed at his disposal for the purpose of prosecuting the work, and it is largely that substantial help which makes it possible to present the finished report at this early date. With this fund it was possible to mail upward of two hundred lists of birds of probable occurrence to different parts of the state for reports from local bird students, and to visit several little known regions of the state for the purpose of studying the bird fauna there at first hand. A list of those who kindly contributed notes and who gave other assistance will be found elsewhere.

The nomenclature adopted in this Catalogue conforms to that of the American Ornithologists' Union Check-List, Second Edition and Supplements succeeding. While this system is not free from faults, and while another revision seems imminent, it is not within the province of this catalogue to anticipate much of such revision. Some questions relating to the validity of species and subspecies which occur in Ohio await settlement. In these few cases I have been obliged to use my best judgment respecting the questions at issue. If that judgment proves unsound I trust that the reader will consider the limitations of time and material under which I am obliged to complete this work.

INTRODUCTION.

SCOPE.

This is not a treatise on descriptive ornithology. The reader who turns to the list of species expecting to learn the color patterns and other characteristics of the several species treated within these covers will be disappointed. Books upon descriptive ornithology are both so numerous and so readily accessible now that it is no longer the province of faunal lists and catalogues to describe birds; they should rather endeavor to contribute to our knowledge of the habits and economic relations. There are added reasons why this catalogue should not attempt to describe the species enumerated. In 1903, there will be ready for distribution a popular scientific work upon the "Birds of Ohio."* This book will be based upon this catalogue, and is being prepared by my friend and colaborer, Rev. William Leon Dawson, of Columbus.

This catalogue is a revision of Dr. J. M. Wheaton's catalogue issued in 1882 as a part of Volume IV of the Ohio Geological Survey. An attempt has been made to draw comparisons between the conditions prevailing then and now, especially as regards the bird life, and to add such facts as further study and improved methods have brought to light. I have not deemed it advisable to reprint much of Dr. Wheaton's catalogue, because a considerable number of copies of that important work may be secured from Mrs. Wheaton, who still resides in Columbus.

*"The Birds of Ohio." A complete, scientific and popular description of the species of birds found in the state. By William Leon Dawson, B.D., with introduction and analytical keys by Lynds Jones, S.M., Instructor in Oberlin College. Illustrated by 80 plates in color-photography, and more than 200 original half-tones, showing the favorite haunts of the birds, flocking, feeding, nesting, etc., from photographs taken by the author and others. Sold only by subscription by The Wheaton Publishing Co., Columbus, Ohio.

THE TASK.

The task of revision involves far more than merely a rearrangement of the groups and species to conform to the present accepted alignment. Many names have been changed wholly or in part, species have been divided into two or more forms, the status of each of which must be determined where they affect Ohio birds. There have been changes in the distribution of some species in the state. Questions of the validity of records of species occurring in Ohio, old as well as new, have presented themselves. The influences of more complete settlement have needed attention. Twice as much time as has been allotted me for this task could have been used profitably, but it is hoped that some worthy results are here presented.

THE PLAN.

While Dr. Wheaton used a somewhat modified form of Dr. Elliot Coues' system of 1874, the present catalogue conforms pretty strictly to the nomenclature and arrangement of the American Ornithologists' Union, revised to date.

The scientific names, with the authority for them, as well as the English names, conform to the above-named Check-List. Under the caption "Synonyms" are given first, the scientific, and second, the English names which have been used to designate the species in other works, the names used by Dr. Wheaton in his 1882 catalogue being given preference where they differ from the present names.

BIBLIOGRAPHY.

Under the caption "Bibliography" only the first published reference to the species as occurring in Ohio is given. While the author has endeavored to verify all references and make certain of accuracy here, his limited reference library must account for inaccuracies. The bibliography of Ohio birds is less extensive than that of many other states, but it is scattered over many minor publications which are difficult to secure. In the appendix will be found as complete a bibliography as the writer has been able to compile after much

patient search. Additions to this list would be gladly received.

RELATIVE ABUNDANCE.

In speaking of the relative abundance in Ohio of the several species of this catalogue I have made use of the more than threescore reports contributed by bird students scattered over most of the state. None of these reports give evidence of any more system in determining the relative abundance than Dr. Wheaton's and his colaborers' work shows, hence the comparisons drawn will seem fair. It is to be hoped that some system for the determination of the relative abundance of birds may soon be brought forward; until that is done we cannot hope for accurate results in this field of knowledge. Dr. Wheaton's observations and those of the persons on whom he relied for information covered only a small fraction of the state, to be sure, but the regions covered may be assumed to have been representative of most of the state at least. It will appear in the discussion of this interesting subject that the author has often quoted himself without the mention of others. Where that is the case the reports received from observers have been too conflicting to be of use, and he has been driven from the unknown to the known. The necessary differences prevailing among bird students as regards the time spent in study, the time of day when the observations are made and the topography covered, furnish no means of comparison unless these elements are known. Field work done at noon only will fail to discover such birds as are quiet during that time. Field work which does not cover certain regions will result in omitting such species as resort only to such regions. Unfamiliarity with notes and songs will often result in the failure to discover certain secretive species, or will fail to notice more than a few where there may be great numbers. Thus it is that only where pretty general agreement obtains, or where there is an evident gradation from one region to another at some distance, that these reports can be wholly relied upon. This does not mean that the accuracy of any ob-

server is questioned, but it only indicates my own ignorance of the conditions under which he worked.

DEFINITION OF TERMS USED TO INDICATE RELATIVE ABUNDANCE.

Lack of any system for indicating what is meant by the terms "Abundant," "Common," "Tolerably Common," "Rare," and "Casual," makes it necessary for each person using them to define his own system. The terms "Accidental," "Hypothetical," and "Introduced," are defined where they are used, after the treatment of the species in the body of the catalogue.

In a general way, the term "Abundant" signifies that the species to which it is applied are so numerous in individuals as to force themselves upon one's notice. The English Sparrow is the only bird to which this term can be applied the year through. A number of species may be abundant at certain times, as the Robin, Vesper Sparrow, Meadowlark, Wood Pewee, and Bronzed Grackle. These and others may be abundant in certain regions and not in others; or in certain restricted localities and either less numerous or even almost wholly absent from other localities near.

A species is regarded as "Common" when a considerable number of individuals may be found without much effort or much expenditure of time. In the use of this term account must always be taken of the habits of the species to which it is applied. Thus, the Oven-bird may properly be entered as common in a region if it be remembered that it is strictly a woods bird. "Common in woods" would be the accurate designation.

"Tolerably Common" is used to indicate the fact that the individuals of the species designated are so few that they must be searched for under normal conditions, and yet present in the region. The Blue-gray Gnatcatcher is a fair example in all parts of the state which I have visited.

"Rare" is the term reserved for a species which is represented by so few individuals that a record of its occurrence is regarded as unusual. In Lorain county the Golden Eagle

is rare, because one or two records of its appearance in a year is all my books show.

"Casual," as used in this catalogue, means that the species to which it is applied visits the state only under unusual circumstances. Thus, the Great Gray Owl could not be expected to reach Ohio except during an unusually severe winter when its food supply north failed. Casual stands close to accidental. A Red-tailed Hawk would be casual in a small city park, because that park lies within its range in the surrounding region. A Bullock Oriole would be accidental there because its home is in regions far removed.

In the use of any of these terms except "Casual," account must be taken of the habits of the birds. The Red-winged Blackbird may be abundant in the marshes of any county, but practically absent from the rest of that county. In the body of the work I have endeavored to indicate what are the regions preferred by the different species. Account must also be taken of the size of the birds to which the terms are applied in each instance. Thus a dozen Red-tailed Hawks in a township would make that hawk appear almost abundant, while a dozen Chipping Sparrows or Robins in that same township would be almost rare for the species.

Some prophet must arise who will be able to develop a system of relative terms for general use. Such a system is greatly needed in the further development of the department of field ornithology.

BREEDING.

Not the least difficult of the problems presenting themselves for solution has been that relating to the breeding of many species within the state. So little was known of the general breeding range of many species when Dr. Wheaton completed his work, that it is not strange that he should have regarded as "probably breeding in the northern parts of the state" several species whose breeding range lies well to the north. It is also more than probable that several species which remained to breed before the state became

so well settled, no longer do so. Remembering the almost total lack of information regarding the southward migrations of many species at that time, we can readily understand how even such keen observers as Drs. Wheaton and Kirtland should have been led to regard as breeding within the state some species which were found in late July. Now we know that they are the vanguard of the southward moving host. We also know that the presence of individuals of a species in summer is not *prima facie* evidence of its breeding, because many unmated birds wander about considerably, and wounded water-birds may be unable to complete their journey and yet be unable to breed where they are obliged to remain. Nor does the author regard the presence of young which the parent or parents are still feeding positive evidence of breeding, if the occurrence lies close to the state border, because it is well known that many young birds which are still largely dependent upon their parents for food are able to fly considerable distances. Such evidence, however, would be strongly probable of breeding. It should not be necessary to actually find a nest with either eggs or young to establish a breeding record. The continuous presence of an evident pair of birds during the season when they would normally breed, in any given restricted region, ought to be taken as clear evidence of the breeding of that pair. It is frequently not possible to find the nest and examine its contents.

The presence in the north of individuals of a species whose normal range lies well south of such occurrence does not indicate that the species breeds in that northern region. During the migrations and after the breeding season individuals may wander considerable distances from their normal breeding places. While the conclusions here reached are by no means to be considered final, they are at least conservative. It may very likely be that some of the warblers supposed to cross Lake Erie to breed will yet prove summer residents on this side. In editing the notes contributed on the breeding of our birds some records have been withheld because of the lack of positive evidence.

FOOD.

An effort has been made to indicate what constitutes the food of the birds which spend much time in the state. In many instances this has been done under the discussion of the individual species, where the species seems to have a strong influence upon agriculture or other economic interests, and where the food differs in some important respects from that of the other members of the group. When the group is not an important factor, or the food of the species is much the same throughout the group, a discussion will be found under the heading of the whole group. Information upon the food habits of the birds has been gleaned from various sources, acknowledgment of which will be found elsewhere. An effort has been made to acquaint the reader with the facts so far as they are known, and thus to show what species are injurious and what beneficial to our interests.

MIGRATION.

The subject of the migrations of the birds into and across Ohio has not received sufficient careful attention to warrant tabulation of the dates of appearance and disappearance of such species as migrate, nor any plotting of the routes of migrations most generally followed. It is true that several voluntary observers have worked faithfully and well with the time at their disposal, and the results have greatly extended our knowledge of the migrations, but their time and means have been too limited for exact results. They have made possible general statements, however, which will indicate the times of appearance and disappearance and the general routes of movement across the state. These general results are given in this catalogue.

RANGE IN OHIO.

The present Ohio range of the different species has been largely taken from the numerous reports received, supplemented by published records and by the writer's work at

Oberlin and in the several regions of the state visited since the preparation of this catalogue began, two years ago. In accepting records for the state and also for the different counties the following rule has been adopted: In order to have a place on the state list a specimen of the species must have been captured and preserved for some time where it could be critically examined. In order to have a place on a county list a species which is rare or casual or accidental in that county must have had a specimen captured and critically examined, or, if a conspicuously marked species, must have been seen under the most favorable conditions by one familiar with that species. This rule has necessarily resulted in the elimination of some species from some of the lists handed me, and has relegated to the state Hypothetical List some species reported on insufficient evidence as occurring in the state. I submit, however, that it is a fair rule, one which will safeguard our work. It is far easier to add a species to such a list than it is to eliminate it after it is wrongly placed there.

TOPOGRAPHY.

"The state of Ohio is situated between $38^{\circ} 25'$ and 42° north latitude and $80^{\circ} 30'$ and $84^{\circ} 50'$ west longitude. It is thus the most southern of the northern tier of states, its northern border corresponding in latitude with the southern border of Michigan and New York. Its extreme length is, from east to west, about 220 miles, its greatest width from north to south about 210 miles. Its area is approximately 40,000 square miles (41,060: land, 40,760; water, 300.)" (Wheaton.) About three-fourths of the state is under cultivation, and of the remaining fourth nearly all is woodland. "Before cultivation a few small prairies in the western and central portions of the state interrupted the general woodland." The disappearance of the forests has resulted in the almost total extermination of a few birds, a marked decrease in the numbers of a large number, and an influx of a few species which live in the open fields.

DRAINAGE.

"Two-thirds of the state may be considered as forming a part of the great Mississippi Valley, while about the northern third is in the basin of the great lakes. The water-shed which divides the streams flowing into Lake Erie from those tributary to the Ohio, traverses the state from near the north-east corner in a south-westerly direction as a low ridge the greatest elevation of which is nowhere more than 1400 feet above the sea. This water-shed is lower in Ohio than in Pennsylvania and New York." (Wheaton.)

ELEVATIONS.

The surface of Lake Erie is 573 feet above the ocean. During low water the Ohio river is about 426 feet above the ocean at the extreme south-west corner of the state, near Gravel Pit, rising to 687 feet at Wellsville in Columbiana county. The Ohio river at its lowest point is thus 147 feet below the surface of lake Erie. The variations in the general surface of the state range from those given above to 1540 feet, which elevation is reached in Logan county a short distance east of Bellefontaine, where two hills rise, the one to 1500 the other to 1540 feet above tide. A hill in Richland county reaches an elevation of 1475 feet. Nowhere else does the state reach 1400 feet elevation. It will thus be clear that nowhere does altitude play any important part in the distribution of the birds.

EROSION.

The lake Erie drainage plain is generally a gradual slope northward, with gorges cut into the underlying shale and rock by the larger streams, but without hills of any consequence. The northern and western parts of the Ohio river drainage plain is also level, but growing rougher as the streams descend and enlarge, reaching a maximum of roughness in the south-eastern and southern parts of the state. The unglaciated region presents the greatest erosion and consequently the highest ridges and deepest valleys. Here the streams have cut completely through the upper coal strata.

RIVERS.

Only two of the rivers which flow into Lake Erie are of much importance topographically—the Maumee at its western end, and the Grand, near the eastern border of the state. Between these the Portage, Sandusky, Huron, Vermilion, Black, Rocky, and Cuyahoga form greater or lesser valleys, and more or less extensive swamps at their junction with the lake. The principal tributaries of the Ohio are the Muskingum, Scioto, and Miami, and their tributaries, penetrating well into the northern third of the state. They are important highways for the birds in their migrations, and several species belonging to the southern counties follow the courses of these rivers farther north than they venture elsewhere.

LAKES.

Natural lakes of any considerable extent are lacking, but within the drift area in the north-east numerous small glacial lakes are scattered. Four reservoirs built by the state to supply the system of canals, furnish inland waters for many species as feeding and nesting places. St. Mary's or Grand reservoir, situated in Mercer and Auglaize counties, with an area of 17,000 acres, is the largest; the Lewiston, in Logan county; the Loramie, in Shelby; and the Licking, in Licking, Fairfield, and Perry counties, are of smaller dimensions. The marshes which have formed in and around these reservoirs support as abundant swamp life as the delta marshes at the lake shore.

THE BIRDS AND THE WATER BODIES.

On the south the Ohio river exerts a marked influence upon the bird fauna of that part of the state. Being a main tributary of the great Mississippi river, and extending in a somewhat northerly direction from that great thoroughfare of the birds, it receives its portion of the northward moving host each spring. The course of the Ohio river is so little varied in character that it is not strange that some species with somewhat southern tendencies should wander along

its course and unwittingly reach a higher latitude than elsewhere. The river itself has, for the most part, little of the character which entices swamp breeders to its shores. While water birds follow its course they do not tarry to breed there, but pass northward.

On the north Lake Erie is a factor to be reckoned with. It acts as a balance between the extremes of cold in winter and heat in summer, thus maintaining a more even temperature at any time of year, preventing the sudden changes which are so dangerous to both plant and animal life. Its chilling spring influence holds vegetation back until time for it to come forth, and by its warm breath in fall it wards off early frosts. Recognizing this influence upon vegetation, we are prepared for the appearance of some of the more southern breeding birds along the shore of the lake, and for the presence all winter of some of the northern species which ordinarily winter much farther south.

It has already been stated that marshes scattered sparingly along the lake front, usually where streams enter the lake, afford breeding places for many species. The archipelago lying north of Sandusky also affords suitable summer homes for many species not found breeding elsewhere in the state. Wherever clay banks front the water Bank Swallows and Belted Kingfishers nest in numbers.

CLIMATE.

For a detailed discussion of the climatic conditions of Ohio the reader is referred to a paper on "Some Climatic Conditions of Ohio," by Mr. Otto E. Jennings, in the Ohio Naturalist for January, 1903. It is sufficient to say here that the mean range of temperature, which is 49° F. in the north and 55° F. in the south, and the much greater depth of snowfall in the extreme north-eastern corner of the state, are the principal factors which exert any marked influence upon bird life. A number of species are not only more common in the warmer southern counties, but several never reach even the middle of the state. Greater snowfall means covered food in winter, and consequently fewer birds during

the period of snow. The rapacious birds, especially, go where food is more easily obtainable during the winter months.

FAUNAL AREAS.

"By far the largest part of the State is strictly Carolinian in its faunal characters; a small portion, the north-eastern corner, is as emphatically Alleghenian." (Wheaton.) Dr. C. Hart Merriam, in "Life Zones and Crop Zones, of the United States," 1898, shows clearly the extent of this arm of the Alleghenian fauna, so far as plant life is affected. I have attempted to indicate this area on the accompanying map. Topographically there seems to be nothing which indicates this difference. It is possible that the influence of the strictly Alleghenian region flows over into Ohio to that extent without any attendant local conditions of topography. A strong hint of the reason for it lies in the much greater snowfall over a large part of this Alleghenian area. The fact that the Hooded Warbler, Worm-eating Warbler, Kentucky Warbler, Golden-winged Warbler, White-eyed Vireo and Summer Tanager invade this area to breed, several of them reaching the lake shore in Ashtabula county, and do not breed as far north anywhere else in the state, would seem to indicate that the conditions which so strongly affect plant life have little or no influence upon these birds. They belong in the Carolinian Fauna.

In northern Ohio there seems a strong tendency toward the Transition Zone, and in the south a strongly typical Carolinian Fauna in the Upper Austral Zone. Thus the Bobolink breeds plentifully all over the northern third of the state, but is scarcely found in summer south of the 40th parallel. Wilson Thrush also breeds north but is absent in summer south. The Black and Common Terns are found only at the lake shore in summer, but the Carolina Wren and Cardinal nest sparingly, but in increasing numbers, even to the lake shore. South of the 40th parallel, except in the extreme north-east, the Kentucky Warbler and Summer Tanager spend the summer.

Careful scrutiny of Dr. Wheaton's work will make apparent to any one that there has been a very perceptible movement of many species northward or north-eastward during the last two decades. Several species known then to breed near the lake shore clearly do not breed there now, or if at all very rarely. Several species which did not reach the lake shore then are regular breeders there now. Some species which were confined to the southern border of the state twenty years ago have now reached the central counties, or pushed even farther north-eastward. Bewick Wren, at least, has invaded the state from the south-west. There is some indication of an invasion of the Blue Grosbeak and Nonpareil soon. In winter, we in the north now have Robins and Bluebirds with us in small numbers, where seven years ago none remained. The temperature is not changing, but the birds are gradually developing into hardier animals.

The species involved in this north-eastward movement may be mentioned. Of the warblers: the Prothonotary, Worm-eating, Golden-winged, Chestnut-sided, Magnolia, Kentucky, and the Hooded. Besides these the Summer Tanager; White-eyed Vireo; Pine Siskin; Lark Sparrow; Dickcissel; Cardinal; Carolina Wren; Bewick Wren; Turkey Vulture; and Wilson Snipe. These are the species most affected. It is more than likely that the whole bird host is gradually shifting northward as the weaker ones perish, leaving only the hardier individuals to occupy the arena of daily strife for existence.

FROM WHENCE BIRDS HAVE COME INTO OHIO.

Birds seem to have appeared upon the earth during the lower Jurassic or possibly even during the upper Triassic times in the world's history. No fossil birds of these times have been found in Ohio, yet it is not impossible that such occurred in the region now named Ohio. However that may be, it is certainly true that the great ice invasion from the north, marking the close of the Tertiary Period and the

beginning of the Quaternary, with its revolutionary changes of climate from almost universal tropic to frigid conditions over the northern half of the northern hemisphere, drove all life out of what is now Ohio. We are therefore concerned only with the reappearance of the birds in the region.

A glance at the accompanying map will indicate the extent of the ice-cap over Ohio. It will be noticed that the south-eastern counties escaped with nothing more than flooding by water in the lowlands when the ice-cap began to recede by melting. It will also be clear that the whole of the state must have been frigid during the most of the year, with perhaps short periods of freedom from snow and ice when the sun was highest in mid-summer. Clearly the conditions were not favorable anywhere in the state then for breeding. Such birds as survived the changes occasioned by the ice invasion, the crowding into the tropics, and the necessary change of diet, must have remained well south of the ice barrier for long periods.

As the ice-cap began to recede in consequence of another change of climate to warmer, the birds, under the necessity of securing more favorable conditions for breeding, must have pushed northward to the limit of the ice, only to be forced south with the approach of winter. With the recurrence of summer and the further recession of the ice these annual migrations would extend farther and farther northward, and the instinct for regular migrations be formed.

This being true, it is clear that the reoccupation of Ohio must have been from a southerly direction. But since the mountains lying eastward and southward now form a considerable barrier to the migrations of the birds, it is likely that they did to an even greater extent then, since time has served to lessen their height. Remembering, also, that birds follow large features of topography in their annual migrations, like river valleys and coast lines, it will seem more than likely that the Ohio tributary of the great Mississippi river served as a highway for the birds living at the close of the Glacial epoch as it does to-day. We are therefore safe in assuming that the first invasion of the region

which is now bounded as Ohio came from the south-west. This is made clearer when we know that the species which have come into the state during the last twenty years to become regular summer residents, have come from the south-west or west. Of the thirteen species regarded as accidental within the state seven must have come from the south-west or west, while five may have come from the east or north-east, at least two of which were pretty clearly driven out of their course by severe storms.

The species which have come into the state since Dr. Wheaton finished his catalogue, or which were not known to him, at least, are as follows: From the south-west and west: Prairie Horned Lark, Henslow Sparrow, Nelson Sparrow, Bachman Sparrow, Little Blue Heron, and Black Rail. The following species have been found as migrants, and can hardly be classed as invaders in the true sense: Parasitic Jaeger, Barrow Golden-eye, American Eider, and Long-billed Dowitcher. Caspian Tern is probably a wanderer from the south.

The following species, known to Dr. Wheaton, have considerably extended their range eastward and north-eastward: Lark Sparrow, Grasshopper Sparrow, Dickcissel, White-eyed Vireo, Prothonotary Warbler, Worm-eating Warbler, Golden-winged Warbler, Kentucky Warbler, Hooded Warbler, Carolina Wren, Bewick Wren, and Carolina Chickadee.

It has already been hinted that there is strong evidence for the belief that several species which earlier ornithologists reported as breeding in the north-eastern counties have ceased to do so, going farther north to spend the summer now. This north-eastward movement can hardly be due to settlement of the country in later years, but rather seems in direct accord with the movement in the same direction of the several species enumerated above. Dr. Merriam shows that a tongue of the Lower Austral life zone reaches about the middle of southern Indiana along the course of the Ohio river. The strong tendency of the birds to follow the course of the Ohio until they reach a latitude considera-

bly north of their normal summer range in Ohio, seems to indicate that this Lower Austral extension may be approaching our southern border, as far as the birds are concerned. This impression is emphasized by the numerous unconfirmed reports of the occurrence of the Nonpareil and Blue Grosbeak in the vicinity of Cincinnati. A further indication of the tendency of the birds, in the latitude of Ohio, to move gradually northward with their breeding range, is shown in the increasing number of species which remain during the entire winter. It indicates that hardier individuals are gradually being developed. Since Ohio lies near the northern border of the breeding range of several species, and just above the northern range of some others, we may expect that the hardiest individuals of such species will gradually invade regions to the north of their range which have not known them hitherto. This law of differentiation is recognized in a practical manner by those who see sub-specific differences between the individuals of certain species which habitually remain well south to breed and those which habitually push well north to breed. This seems to be one of the methods for the development of species.

The appearance of northern breeding birds in the state in winter cannot properly be classed as invasions, because they are forced south by the stress of hunger, and return at the first opportunity. It seems clear that during the migrations of the species which breed north of the state, the movement of species in the western end of the state is a little west of north, and in the eastern part of the state a little east of north. While Lake Erie is not an insurmountable barrier to most species, they seem to prefer not to cross it directly or at all if possible. I have repeatedly seen Killdeer and Meadowlarks strike out boldly for the Canada side, with a favorable wind, only to turn back before they had passed out of sight. It is more than likely that many individuals of the species which migrate by day pass around the ends of the lake, or cross at Sandusky.

SOURCES OF INFORMATION.

In the preparation of this catalogue the author has received much valuable assistance from many sources. He has freely consulted first of all Dr. J. M. Wheaton's great work, and has taken from it many facts. Cook's "Birds of Michigan," Butler's "Birds of Indiana," Warren's "Birds of Pennsylvania," Ridgway's "Birds of North and Middle America," and Nehrling's "Our Native Birds of Song and Beauty," have proved valuable helps in many ways. Without the material support and hearty coöperation of the Ohio State Academy of Science, particularly its committee having in charge the McMillin Fund for research, this catalogue would not have appeared at this time. To Professor Albert A. Wright, for valuable and timely suggestions and for help in the selection of a map; and to Rev. W. L. Dawson, for coöperation and criticism in the compilation of the list of species, I desire to make grateful acknowledgment here. To all those whose names appear below, who gave freely of their time and knowledge of the birds in their localities, is largely due the approximation to completeness of this catalogue. Many have gone out of their way to help the work along. With such an enthusiastic company of friends there is great hope for the future of our native birds.

CONTRIBUTORS.

The following persons have returned lists of the birds of their localities checked upon provisional lists which were furnished for that purpose:

- Allen—Homer C. Bennett, M.D., Lima.
- Ashland—C. L. Metcalf, McZena.
- Ashtabula—W. P. Holt, Rev. J. M. Keck, Geneva, Robt. J. Sim, A. W. Galpin, Jefferson.
- Clark—Leander S. Keyser, Springfield.
- Columbiana—T. C. Randolph, J. W. Suliot, Salem.
- Crawford—Hiram B. Sears, Bucyrus.
- Cuyahoga—A. Hall, Lakewood; Prof. Francis H. Herrick, R. J. Tozer, Cleveland.

- Defiance—Charles E. Slocum, M.D., Defiance.
Delaware—Miss Ida Newell, Prof. Edward L. Rice. Delaware.
Erie—R. L. Baird, Prof. E. L. Moseley, R. D. L. Ransom, Sandusky; Carl Tuttle, M.D., Berlin Heights.
Franklin—Rev. W. L. Dawson, Prof. J. S. Hine, Columbus.
Fulton—Thomas Mikesell, Wauseon.
Geauga—Rev. J. M. Keck, Orange Cook, Chardon.
Greene—Eliza G. Rice, Yellow Springs.
Hamilton—Charles Dury, Russell Everett, Laura Gano, F. W. Langdon, M.D., Joshua Lindhal, Morris Peck, C. C. Smith, Francis P. Smith, Cincinnati; R. F. Souter, Bond Hill.
Hardin—George H. Palmer, Kenton; Agnew Welsh, Ada.
Harrison—Harry B. McConnell, Cadiz.
Knox—T. E. Haughey, Academia.
Lake—E. A. Doolittle, V. E. and T. B. Wyman, Painesville; Rev. J. M. Keck, Mentor.
Licking—Irving A. Field, Granville; Raymond Osburn, Vannatta.
Logan—Homer C. Bennett, M.D., Bellefontaine.
Lorain—Lynds Jones, Oberlin.
Lucas—F. H. Burtlehouse, Miss Lucy J. Retscher, Toledo.
Madison—Max Morse, London.
Mahoning—E. W. Vickers, Ellsworth.
Morgan—E. J. Arrick, C. H. Morris, McConnellsville.
Perry—Rev. Henry Beeman, New Lexington; Geo. W. DeLong, Corning.
Pike—Rev. W. F. Henninger, Waverly.
Portage—Cornelius Baldwin, Nelson; Geo. H. Colton, Hiram; Roscoe J. Webb, Garrettsville.
Preble—Julia K. Holn, Lewisburg.
Scioto—Rev. W. F. Henninger, South Webster.
Summit—Eugene F. Cranz, Ira; Wm. B. Haynes, Akron.
Union—Lizzie A. Copp, Richwood.
Warren—Anna C. Stenson, Harveysburg.
Wayne—J. G. Black, Scott G. Harry, Harry C. Oberholser, Ethel Dane Roberts, Wooster.
Wyandot—Thos. A. Bonser, Carey; Paul Smith, Upper Sandusky.

In addition to the names mentioned above, valuable notes have been received from Dr. W. H. Fisher, of Cincinnati, from his records of specimens in his private collection, relating to food and the occurrence of many species, and from Mr. E. B. Williamson, giving dates of nesting of many species in various places in the state. Clippings from lo-

cal newspapers in which birds are mentioned, which have been sent to me by many helpers, are too numerous and the sources from which they came too various to be given individual mention here.

Dr. Frank W. Langdon, Mr. Charles Dury and Dr. Josua Lindahl have contributed notes covering a long series of years in the vicinity of Cincinnati and elsewhere in the state; and Mr. Wm. B. Haynes, of Akron, has given special attention to the shore birds of the natural lakes of that vicinity.

Mr. H. C. Oberholser has been good enough to go over the list of species here recorded, making suggestions and comments which have greatly aided me in the final arrangement of the catalogue. His "Birds of Wayne County, Ohio," and Rev. W. F. Henninger's "Birds of Middle Southern Ohio," have been valuable aids in the revision of the work.

In 1891 Messrs. L. M. McCormick and G. D. Wilder prepared a list of the birds of Lorain county, from which I have been able to add not a little to our knowledge of the birds of the northern parts of our state.

To these gentlemen and to all who have given so freely of their time and notes I wish to tender my grateful thanks. They have made a difficult task possible of accomplishment.

In addition to the counties represented upon the list given above, the writer has been able to spend a greater or less time in studying the birds in the following counties: Athens, Fairfield, Gallia, Huron, Lawrence, Medina, Meigs, Muskingum, Ottawa (islands only), Perry, and Washington. The work in all of these counties, except Huron and Medina, was done in company with Rev. W. L. Dawson. At Chippewa Lake, Medina county, Mr. R. L. Baird accompanied me. Mr. Baird has also been associated with me in considerable of the later work about Oberlin. At the Licking Reservoir, which included parts of Licking, Fairfield, and Perry counties, Messrs. E. J. Arrick and Irving A. Field also participated. Several days were spent in the vicinity of Jefferson, Ashtabula county, with Mr. Robt. J.

Sim. Most of the work in Erie and Huron counties has been without company.

From the foregoing remarks it will be clear that a considerable portion of the state remains to be explored ornithologically, particularly in the south and west. Some persons with considerable leisure ought to be posted along our southern and western borders to watch for invasions of species from Kentucky and Indiana. I earnestly hope that the appearance of this catalogue will mark the beginning of an era of unusual activity in the study of the birds of our fair state.

THE BIRDS OF OHIO.

ORDER PYGOPODES. Diving Birds.

SUBORDER PODICIPEDES. Grebes.

Family PODICIPIDÆ. Grebes.

This family is represented in our state by three species, one large and two small. The food consists of fish, aquatic insects, crustaceans, batrachians, and considerable aquatic vegetable matter. The grebes pursue the fish under water, using only the feet in swimming under water. A Horned Grebe found on the streets of Oberlin, February 9, 1895, by Mr. H. C. Tracy, had completely filled its gizzard with small rubber bands, probably picked up on the street under the supposition that they were worms. The bird was found in an exhausted condition, and soon died.

(The first number at the left is the serial number of this catalogue. The second number, which is in parenthesis, is the present number of the species in the Check-List of the American Ornithologists' Union. The number to the right of the scientific name and authority is the number found in Dr. Wheaton's Check-List, pages 571-584, of his catalogue.)

1. (2.) *COLYMBUS HOLBÆLLII* (Reinh.). 287.
Holbæll Grebe.

Synonyms: *Podiceps grisigena* var. *holbælli*, P. *holbælli*; P. *grisigena*.

American Red-necked Grebe, Red-necked Grebe.

Kirtland, Ohio Geol. Surv., 1838, 166, 187. (*Podiceps rubricollis*.)

This is a rare and irregular winter visitor and migrant, upon almost any of the Ohio lakes, reservoirs or rivers. There have been fewer records since Dr. Wheaton's catalogue was printed than before.

2. (3.) *COLYMBUS AURITUS* Linn. 288.
Horned Grebe.

Synonyms: *Dytes auritus*, *Podiceps cornutus*.

Audubon, Orn. Biog., III, 1835, 429.

While this grebe is not common during the migrations it can hardly be called rare in most parts of the state. It is somewhat regular as a migrant, but may be found during the winter. Companies of a dozen or more individuals in full spring dress are not infrequent on Lake Erie. During the southward migration there is a strong tendency for the birds to occur two at a time on the smaller waters. The report of the breeding of this species in Ottawa county has not been confirmed.

This grebe is as good a diver as the more familiar Pied-billed, for which it is often mistaken. The slenderness of the bill should always easily distinguish it from that species.

In the migrations the Horned Grebe reaches Oberlin about the middle of April and remains until about the first of May. It returns early in October and tarries until ice forms on the ponds, and may be found at any time during the winter about open water.

3. (6.) *PODILYMBUS PODICEPS* (Linn.). 289.
Pied-billed Grebe.

Synonyms: *Podiceps carolinensis*, *Colymbus podiceps*.

Pied-billed Dabchick, Thick-billed Grebe, Dabchick, Dipper, Didipper, Diedapper, Water-witch, Hell-diver, Devil-diver.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

This is the most familiar grebe in Ohio, known by a diversity of names to suit the experiences of each individual hunter. However, the modern shot-gun or rifle is too quick for him. To be sure he sometimes succeeds in dodging the lead thrown at him, but far oftener he falls a victim to it, as the breasts which may be seen on hats and in boas too well show.

This grebe nests sparingly all over the state where conditions may be favorable. One could hardly call the species

common anywhere, but individuals are to be found during the spring and fall months, on almost any body of water a half acre in extent.

Lorain county dates for spring appearance fall within the last week of March, and the departures during the second week in October.

SUBORDER CEPPHI. Loons, Auks, Murres etc.

Family GAVIIDÆ. Loons.

Three species belonging to this family inhabit Ohio more or less regularly. Only one species, the Loon, is regular in its appearance, the other two reach the state only in severe winters. The food is similar to that of the Grebes, with a larger proportion of fish, probably, and somewhat less of vegetable matter.

4. (7.) GAVIA IMBER (Gunn.). 290.

Loon.

Synonyms: *Colymbus torquatus*, *C. imber*, *C. glacialis*, *Urinator imber*.

Great Northern Diver, Common Loon.

Kirtland, Ohio Geol. Surv., 1838, 166, 186.

The Loon is no longer a common bird anywhere in the state, but it is not infrequently seen during the migrations on the larger waters. It is apparently a rare summer resident in the region of Sandusky and Toledo, and possibly elsewhere along the lake shore.

At Oberlin it has been seen in late April and early October, but no definite dates of migration can be given. Rev. Mr. Henninger has found it as late as the first of May at Piketon.

5. (9.) GAVIA ARCTICA (Linn.). 291.

BLACK-THROATED LOON.

Synonyms: *Colymbus arcticus*, *Urinator arcticus*.

Black-throated Diver.

Wheaton, Ohio Geol. Surv., 1882, 565.

This loon is casual as a winter visitor in the state. There have been a number of specimens captured since that recorded by Dr. Wheaton, which was captured near Kelley's Island instead of in Sandusky Bay, Mr. Roscoe J. Webb, who secured the specimen from Mr. Crane in whose collection it was, tells me.

6. (11.) *GAVIA LUMME* (Gunn.). 292.

Red-throated Loon.

Synonyms: *Colymbus septentrionalis*, *Urinator lumme*, *Colymbus lumme*.

Red-throated Diver.

Wheaton, Ohio Agri. Rep. for 1860, 371, 379.

This loon is everywhere rare in the state. It has been taken at Cincinnati, according to Mr. Dury and Dr. Langdon, and at Wheelersburg, Scioto county, by Rev. Mr. Henninger. It is rare on Lake Erie. No dates of migration can be given, but it is probably to be found in late March.

ORDER LONGIPENNES. Long-winged Swimmers.

Family STERCORARIIDÆ. Skuas and Jaegers.

Two species of this small family reach our state more or less regularly, but are rare everywhere. They are the birds of prey among the gulls and terns, getting a large part of their living by forcing the gulls and terns to drop their catch of fish, thus stealing it from them. It is not clear whether these birds ever eat the garbage thrown out from cities into the ocean; if hard pressed for food they might do so.

7. (36.) *STERCORARIUS POMARINUS* (Temm.). 286.

Pomarine Jaeger.

Synonyms: *Stercorarius pomatorhinus*, *Larus pomarinus*.
Wheaton, Ohio Geol. Surv., 1882, 545.

The records of this rare species are as follows: H. E. Chubb, Cleveland, fall of 1880 (Wheaton, 1882); E. L.

Moseley, Sandusky, Oct., 1889 (Cook, Birds of Michigan, 26); A. Hengartner, Lorain, date not known. It is likely to be found on any of the larger waters with flocks or companies of gulls.

8. (37.) STERCORARIUS PARASITICUS (Linn.). —
Parasitic Jaeger.

Synonyms: *Larus parasiticus*.

Smith, Raymond W., Journal Cin. Soc. Nat. Hist., XIV, 1891, 107.

The specimen here recorded was captured near Lebanon, at the close of a week of very stormy weather, in the latter part of March or the early part of April, 1880. Name of captor not given. It was given to Mr. J. E. Gould, who preserved it in his collection. This appears to be the first published record.

E. L. Moseley reports three specimens preserved in local collections in Sandusky as follows: Oct. 6, 1895; Sept. 13, 1899; also 'a Jaeger probably of this species Sept. 20, 1889,' Frey. There is a specimen of this species in the collection of Mr. A. Hengartner, Lorain, which Mr. Hengartner shot near Lorain on the lake shore.

Another specimen is recorded by Prof. F. M. Comstock, in *The Auk*, XIII, 1896, 171, captured near Sandusky, in November, 1895. Prof. Comstock also mentions a record in the Cleveland Academy of Science Proceedings, by Dr. Kirtland, of a specimen probably of this species captured at the mouth of Rocky River, in November, 1857. Volume and date of the publication not given.

Family LARIDÆ. Gulls and Terns.

Sub-family LARINÆ. Gulls.

The gulls differ from the terns in generally larger size and in their manner of feeding, as well as somewhat in the food eaten. There are two gulls regularly found in the

state at some time of the year, and five which appear occasionally.

While flying over the water in search of food they hold the head horizontally, so that the bill is in a line with the body. They do not plunge into the water for a fish or other food, but settle upon it, or take fish or other food from the surface. They catch fish alive, eat dead fish which may be thrown upon the shore by the waves, and eat greedily of the garbage thrown out from coast cities. The smaller gulls may also eat some insects. Gulls often follow in the wake of ships and snatch any morsel of food which may be thrown into the water.

As scavengers the gulls take first rank because they are the most numerous birds along our coasts. They congregate about the garbage scows in great numbers and prevent garbage from washing ashore to pollute earth and air. The laws for their protection should leave no room for a doubt as to their meaning in the mind of any one.

9. (43.) *LARUS LEUCOPTERUS* Faber. 274.
Iceland Gull.

Synonyms: White-winged Gull.

Wheaton, Ohio Agri. Report, 1860, 370, 379.

Besides the record which Dr. Wheaton has left us, of the capture of two or three specimens in Cleveland harbor, on the authority of Mr. R. K. Winslow, the only record is for Lorain, Dec. 22, 1888, on the authority of Mr. L. M. McCormick. A specimen was captured near Lorain on the lake, and preserved in the Oberlin College museum.

10. (47.) *LARUS MARINUS* Linn. 275.
Great Black-backed Gull.

Synonyms: Saddle-back, Coffin-carrier, Cobb.

Audubon, Orn. Biog., III, 1835, 98.

Dr. Wheaton's records for this gull are admittedly weak, and I am therefore glad to strengthen them by one actual capture and one other record which is hardly open to ques-

tion. Mr. E. W. Vickers reports "One found dead floating among ice in the creek near Canton." Rev. W. F. Henninger adds another record for Pike county, March 21, 1901. (Wilson Bulletin No. 40, 1902, page 79.) Individuals should be found occasionally on Lake Erie during the winter, and wanderers might occasionally reach Kentucky.

11. (51.) *LARUS ARGENTATUS* Brünn. 276.
Herring Gull.

Synonyms: *Larus argentatus smithsonianus*.
American Herring Gull.

Audubon, Orn. Biog., III, 1835, 98.

It is, perhaps, not quite true that this gull is a resident in the state in spite of the fact that birds have been seen on the lake shore during every week in the year, because there are no breeding records. Probably the summer birds were wandering males or unmated birds. It is a common bird locally on the larger streams and lakes during the migrations, but does not seem to be a winter resident upon any of the inland waters, except possibly the Ohio river.

The Lake Erie flocks are much larger after the middle of March than during the winter. Only during the period when the lake is well filled with ice are the numbers few. During the severest weather they remain near the fish houses or follow the ice cutters, unless there be rifts of open water not far out.

12. (54.) *LARUS DELAWARENSIS* Ord. 277.
Ring-billed Gull.

Synonyms: Common American Gull.

Audubon, Orn. Biog., III, 1835, 98.

I have looked for this gull in vain. It is reported as rare everywhere in the state. What Dr. Wheaton says of it would indicate that even as he wrote in 1882, the numbers were growing considerably less. There appears to be no evidence of its breeding within the state. It is possible that several of the gulls formerly nested on the islands within

the international boundary, before they were so fully settled, but positive evidence of the breeding of this species is lacking.

13. (60.) *LARUS PHILADELPHIA* (Ord.). 278.
Bonaparte Gull.

Synonyms: *Larus capistriatus*, *L. bonapartii*, *Choicocephalus philadelphia*, *Sterna philadelphia*.
Bonaparte's Rosy Gull.

Audubon, Orn. Biog., IV, 1838, 212.

This is the most common small gull, but it is only locally common during the migrations. It is said to breed on Gull Island in Lake Erie, but I have been unable to verify this statement. It was not found on the small islands north of our boundary. Migration dates are unsatisfactory and irregular. The species probably reaches the state in late April.

14. (62.) *XEMA SABINII* (Sab.). 279.
Sabine Gull.

Synonyms: *Larus sabinii*, *Xema sabinei*.
Fork-tailed Gull.

Wheaton, Ohio Agri. Report, 1860, 371, 379.

This record is apparently based upon a single specimen in immature plumage captured in Cleveland harbor by Mr. R. K. Winslow, earlier than 1880, and preserved for a time in the collection of the Ohio Medical College. It had been destroyed previous to 1882.

Subfamily STERNINÆ. Terns.

Seven species of terns occur in Ohio, the Common and Black being the only regular visitors in summer. Terns fly with the bill pointing down instead of forward, and the species which we find have a forked tail, while the gulls have a square cut tail. The terns dive into the water for fish. They also eat garbage, and the smaller ones, at least, feed upon insects after the fashion of the swallows. As scavengers they are useful birds, but doubly increase our debt to

them by feeding upon insects as well. The law against killing or injuring gulls and terns should be carefully observed and rigidly enforced. It is unlawful to possess any part of a gull or tern, as well as any part of most other wild birds, in Ohio.

15. (63.) GELOCHELIDON NILOTICA (Hasselq.). 280.
Gull-billed Tern.

Synonyms: *Sterna anglica*, *S. aranea*, *S. nilotica*.
Marsh Tern.

Kirtland, Ohio Geol. Surv., 1838, 166, 185.

Its place on our list is based upon the above reference, and upon specimens reported by Mr. R. K. Winslow for the vicinity of Cleveland. It seems likely that more familiarity with this species will prove that it is more regular as a summer visitor than has been supposed.

It has not been found in Indiana nor in the western part of Pennsylvania, but it is reported as breeding on the St. Clair flats.

16. (64.) STERNA CASPIA (Pall.). —.
Caspian Tern.

Synonyms: *Sterna tschegrava*.
Imperial Tern.

Dury, Catalogue of Birds, Animals and Fishes, 1886, 4.

Mr. Charles Dury reports specimens from Ross lake, Little Miami river, Ohio river near the Miami river; specimens from which places are in his collection and in that of the Cincinnati Society of Natural History. Prof. Moseley reports it from Sandusky. I have a record for Licking reservoir, May 31, 1902. It must be regarded as a summer straggler in the state.

17. (69.) STERNA FORSTERI Nutt. 281.
Forster Tern.

Wheaton, Ohio Agri. Report, 1874, 515.

Forster Tern is apparently casual in the state. I have received no records since those given by Dr. Wheaton. The

difficulty of identifying this tern renders it probable that many occurrences are not noted.

"Mr. Langdon gives it as a rare migrant in the vicinity of Cincinnati, where Messrs. Dury and Freeman note six specimens taken May 4, 1879. My own experience with the bird in this vicinity is limited to a single specimen taken in the fall of 1861 or 1862." (Wheaton.)

18. (70.) STERNA HIRUNDO Linn. 282.
Common Tern.

Synonyms: *Sterna fluviatilis*, *S. wilsonii*.

Wilson's Tern, Sea Swallow.

Nuttall, Man., II, 1834, 271.

As its name implies, this tern is the common form during the migrations wherever there is a lake or large stream. It is not everywhere common, however, but may be locally so anywhere in the state. It breeds in large numbers on the islands just north of our boundary, and less numerously on a few of the smaller islands within our boundary. It has been reported as breeding at Sandusky, but no nests appear to have been found there. The birds seen during the summer in the bay and that vicinity are clearly not breeding birds but wanderers in search of food.

During the second week in May it is abundant along the lake front, then usually appearing in loose companies of from ten to fifty or more individuals.

The migrations occur during the first week in May, or the last week in April, and from the first week in August well into October or even November in the southern counties.

19. (72.) STERNA DOUGALLI Montag. 283.
Roseate Tern.

Synonyms: *Sterna paradisea*.

Paradise Tern.

Audubon, Orn. Biog. III, 1835, 98.

According to the records this species has been found in Ohio less than a half dozen times, once at Cincinnati by Dr. Frank W. Langdon, and the others at the lake shore.

20. (74.) STERNA ANTILLARUM (Less.). 284.
Least Tern.

Synonyms: *Sterna minuta*, *S. frenata*, *S. superciliaris*, *Sternula antillarum*, *Sterna superciliaris antillarum*.

Audubon, Orn. Biog., IV, 1838, 175.

The records for this tern are few but well scattered over the state. It appears to be a rare migrant everywhere. I have never seen it at the lake shore. Its routes of migration may be largely confined to the western half of the state.

21. (77.) HYDROCHELIDON NIGRA SURINAMENSIS (Gmel.).
285.
Black Tern.

Synonyms: *Hydrochelidon lariformis surinamensis*, *H. lariformis*, *H. plumbea*, *H. fissipes*, *Sterna nigra*, *S. surinamensis*.

Short-tailed Tern.

Audubon, Orn. Biog., III, 1835, 535.

The Black Tern is nowhere as common as the Common Tern, but it is not at all rare as a summer resident in the vicinity of Sandusky and Toledo. I have been unable to find it farther east as a summer resident. While the Common Terns breed upon the islands well up from the water the Black Terns choose the marshes, building a nest on the rotten floating vegetation in the swamps where there is no danger from waves.

The spring migrations occur during the second week in May at Oberlin, but probably a week earlier in the region of Sandusky. I have no records for the departure southward. We found them on the Ohio river late in August.

ORDER STEGANOPODES. Totipalmate Swimmers.

Family PHALACROCORACIDÆ. Cormorants.

One member of this family passes across Ohio, and nested in former years. Cormorants are great fish eaters, and probably eat little if anything else. The Chinese train them to fish for them.

22. (120.) PHALACROCORAX DILOPHUS (Swain). 272.
Double-crested Cormorant.

Synonyms: *Graculus dilophus*, *Pelecanus* (*Carbo*) *dilophus*.
Wheaton, Ohio Agri. Report, 1874, 575.

The cormorants are not well enough known to give us much of an idea of their distribution in the state. This one appears to be a rare migrant in the western half, probably, passing across the state without stopping usually, since there is no suitable feeding place except the reservoirs. Dr. Wheaton states that this species may have nested at the Licking reservoir in earlier years. Mr. Dury found it nesting at St. Mary's reservoir more than twenty years ago.

Family PELECANIDÆ. Pelicans.

Of the three species in this family only the American White Pelican is found in Ohio. This pelican lives upon fish which it scoops up from the water in the capacious pouch hanging to its lower mandible. There is no evidence that it carries either fish or water in the pouch while flying, since its young are fed upon partially digested fish disgorged from its crop.

23. (125.) PELECANUS ERYTHORHYNCHOS Cmel. 271.
American White Pelican.

Synonyms: *Pelecanus trachyrhynchus*, *P. onocrotalus*.
White Pelican.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

The pelican is a rare migrant across the state. So conspicuous a bird would be reported generally if it occurred. One was shot at the Licking reservoir about May 15, 1902. It has been seen at Oberlin twice. The records are few and scattering, but seem to indicate that it is confined to the western half of the state.

ORDER ANSERES. Lamellirostral Swimmers.

Family ANATIDÆ. Ducks, Geese, and Swans.

The members of this order must be treated under the sub-family groups.

Subfamily MERGINÆ. Mergansers.

All three American members of this subfamily occur in Ohio somewhat regularly during the migrations. They are properly designated "Fish Ducks," because they feed largely upon fish, but probably also eat mollusks, crustaceans, frogs, and other aquatic animals to some extent. Dr. Warren states that in diving they use the wings as well as the feet for propulsion. On the surface of the water they certainly use their wings when hard pressed to get away, but are unable to fly up. The flesh of the two larger species is rank and fishy, but the Hooded Merganser is a table delicacy.

24. (129.) Merganser AMERICANUS (Cass.). 268.
American Merganser.

Synonyms: *Mergus merganser*, *M. m. americanus*, *M. americanus*.

Merganser, Goosander, Fish Duck, American Sheldrake.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

Both mergansers remain all winter where there may be open water sufficient for feeding. This form appears to be the more common of the two belonging to the genus *Mergus*. It is found on Lake Erie well into January, but is not found during the period when the lake is ice bound—during the most of February and sometimes the first week of March. It has passed north by the third week in April.

25. (130.) Merganser SERRATOR (Linn.). 269.
Red-breasted Merganser.

Synonyms: *Mergus serrator*.

Red-breasted Sheldrake.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

This "Fish Duck" is not only less common than the preceding species, but is even rare over most of the state. It is seldom seen during the winter months, but must still be considered a winter visitor as well as a rare migrant across the state. Its occurrences are too few and too scattered to assign migration dates.

26. (131.) *LOPHODYTES CUCULLATUS* (Linn.). 270.
Hooded Merganser.

Synonyms: *Mergus cucullatus*.

Saw-bill, Topknot, Hooded Sheldrake.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

While this merganser is rather more numerous than either of the larger species, it is only locally common in the state as a migrant. There are no records of its breeding within our borders. While the others are more frequently seen on the lakes and larger streams, this is a river duck as far as its habits and routes of migration are concerned. I have never seen it except on the smaller streams and ponds. It visits the Oberlin water-works reservoir during the spring, with the hosts of other ducks, but always keeps to itself while resting and feeding. The conspicuous "hood" with the large white patch in its center, furnishes a mark for certain identification of the breeding males.

The Hooded Merganser passes Oberlin about the middle of April. It is seldom seen during more than a week all together.

Subfamily ANATINÆ. River Ducks.

This subfamily is represented by an even dozen species and subspecies in Ohio, two of which are accidental in the state. The River Ducks are dabblers in shallow water, turning tail up and immersing only the head, neck, and fore part of the body when feeding. It does not, therefore, follow that they never dive, for they often do. The food of this group is largely vegetable, both aquatic and non-aquatic; weed seeds comprise a good part. The flesh

of all is considered a great delicacy. The birds do not feed entirely in the water, but may often be found on the land, especially during the summer months.

27. (132.) *ANAS BOSCHAS* Linn. 247.
Mallard.

Synonyms: *Anas domestica*.

Kirtland, Preliminary Report, Ohio Geol. Surv., 1838, 67.

The Mallard is locally common during the migrations, but it is almost absent from many localities. It breeds irregularly from the southern border of the state at least to Columbus, and seems rather more common as a summer resident in the northern half, but is very local in its summer distribution anywhere in the state. It is seldom that anything but small flocks are seen in the migrations. At the lakes and marshes they may be found in greater numbers together. It is probably true that males of this species may be found during the summer much farther south and in many localities in the state where there are no breeding females. The males are wanderers and apparently have no care for the brood.

The migrations of the Mallard begin during the first week in March, at Oberlin, and continue well toward the close of the month. Individuals that were clearly migrating have been seen as late as the middle of April. The southward migrations are at their height about the middle of November, but vary with the weather.

28. (133.) *ANAS OBSCURA* Gmel. 248.
Black Duck.

Synonym: Dusky Duck.

Kirtland, Preliminary Report, Ohio Geol. Surv., 1838, 67.

The recent division of this species into two forms makes it doubtful what the status of the two forms for Ohio is. An examination of skins in two collections indicates that this form is the less common in Ohio.

Dr. Wheaton regarded the Black Duck as a casual sum-

mer resident in the northern parts of the state, but I find no corroborative evidence to that effect. It is more often seen in pairs or singly than the Mallard, and appears to be less wary, frequenting small ponds and streams which the Mallard avoids.

The migrations occur at the same time as the Mallard, with possibly a little earlier return in the autumn.

29. (133a.) *ANAS OBSCURA RUBRIPES* Brewst.
Red-legged Black Duck.

Henninger, Wilson Bulletin, No. 41, 1902, page 134.

The recent addition of this subspecies to our fauna makes any statement about its range in the state of little value. It seems likely to be found not uncommon during the migrations, probably in company with the Black Duck. Collections seem to indicate that this is the more common form for Ohio, if it does not prove to be the regular migrant to the almost exclusion of the other form. Ohio collections contain both forms.

30. (135.) *CHAULELASMUS STREPERUS* (Linn.). 249.
Gadwall.

Synonyms: *Anas strepera*.
Gray Duck.

Kirtland, Ohio Geol. Surv., 1838, 166, 186.

The Gadwall appears to be rare as a migrant. Reports are not only few but generally unsatisfactory. It is certainly among the disappearing ducks in Lorain county. Prior to 1885 it was one of the market ducks on the lake shore, but it is not seen there now. I have no migration records that will give any idea of the movements of this species.

31. (137.) *MARECA AMERICANA* (Gmel.). 251.
Baldpate.

Synonyms: *Anas americana*.
American Widgeon.

Kirtland, Preliminary Report, Ohio Geol. Surv., 1832, 67.

This once abundant duck is now common only locally and there only occasionally. It has become wary and hard to approach. In Lorain county I have seen only single individuals and two together, and they on the smaller unfrequented ponds. Lately several have formed the habit of visiting our water-works reservoir, in spite of the fact that it lies well within the town. If it breeds within the state now there is no mention of that fact in the reports received. Dr. Langdon mentions its breeding in Ottawa county.

Migration dates for the spring movements fall within the third week of March for southern Ohio, but almost a month later for Oberlin. The southward movement occurs late in October.

32. (139). *NETTION CAROLINENSIS* (Gmel.). 254.
Green-winged Teal.

Synonyms: *Anas carolinensis*, *Querquedula carolinensis*.
American Green-winged Teal.

Audubon, Orn. Biog., III, 1835, 219.

This teal is reported as a common migrant across the state. It is the earlier of the two teals, arriving with the Mallards and other early ducks. I have seen several individuals of this species migrating in flocks of Mallards. It has not yet been found in Lorain county during my studies anywhere but on the lake. None have visited our water-works reservoir.

33. (140.) *QUERQUEDULA DISCORS* (Linn.). 253.
Blue-winged Teal.

Synonyms: *Anas discors*.

Kirtland, Preliminary Report Ohio Geol. Surv., 1838, 67.

This is a common duck locally during the migrations, but it is clearly less common than during Dr. Wheaton's time. It may be found on the smaller streams and ponds as well as on the larger rivers and lakes. In Lorain county I have found it only on the small ponds in twos and threes or singly. Flocks are sometimes seen passing northward.

The spring migrations are late for a duck, occurring during late April, and the fall migrations in October.

Dr. Langdon found it breeding in Ottawa county years ago, but there are no recent records of its nesting there.

34. (142.) *SPATULA CLYPEATA* (Linn.) 252.
Shoveller.

Synonyms: *Anas clypeata*.
Spoon-bill, Broad-bill.

Kirtland, Ohio Geol. Surv., 1838, 166.

From a "very common migrant" this duck has become almost rare everywhere in the state. It has been recorded less than a dozen times, in the last fifteen years, in Lorain county, and then either singly or in small companies. If it once nested in the state it has ceased to do so. Dr. Wheaton inclined to the belief that it would be found nesting in the northwestern counties. I have been unable to verify this.

It may be found during March and as late as December. Migration dates are too scattering to give its movements accurately.

35. (143.) *DAFILA ACUTA* (Linn.). 250.
Pintail.

Synonyms: *Anas acuta*.
Spring-tail, Sprig-tail.

Kirtland, Ohio Geol. Surv., 1838, 166, 186.

The Pintail appears to be about the most numerous of the ducks sought after by the hunters. It is seen in considerable flocks during both the spring and autumn migrations, and not infrequently stops on the smaller ponds and streams. It is always wary and hard to approach. It sometimes remains all winter in favorable localities, but has not been known to breed.

The migrations of this duck begin late in February or early in March, and may continue until the first week in April at the lake shore. It comes south with the first touch

of winter, and is gone from the northern parts of the state with the freezing of the streams and ponds.

36. (144.) *AIX SPONSA* (Linn.). 255.
Wood Duck.

Synonyms: *Anas sponsa*.

Summer Duck, Tree Duck, The Bride.

Audubon, Orn. Biog., III, 1835, 52.

This duck breeds throughout the state in favorable localities. It nests in the woods some distance from water, but must have feeding places within reach of the nest. The young are said to be carried to the water when hatched. There seems to be little difference in numbers during the migrations from those during summer. It can hardly be called a common species, yet it is hardly rare. The first birds appear at Oberlin about the middle of April and are gone by the last of October.

Subfamily *FULIGULINÆ*. Sea and Bay Ducks.

Fourteen species represent this family in our state, some of them being rare. The members of this group dive when feeding, frequently to considerable depths. Their food consists of the seeds and roots of aquatic plants, mollusks, crustaceans, and some fish in winter. Some members of the group dive as readily as the true divers. Most of the species are found in flocks of varying size during the migrations.

37. (146.) *AYTHYA AMERICANA* (Eyt.). 260.
Redhead.

Synonyms: *Æthya americana*, *Fuligula ferina* var. *americana*,
F. ferina, *F. americana*.

Pochard, American Pochard.

Kirtland, Preliminary Report Ohio Geol. Surv., 1838, 67.

The Redhead is only tolerably common as a migrant. It visits the ponds and small streams as well as the larger bodies of water. It is a fairly regular visitor to the Oberlin water-works reservoir both spring and autumn.

Its migrations cover the period from the second week in March to the second week in April, and at the same period in October and November, except that it may tarry even into December in favorable years.

38. (147.) *AYTHYA VALLISNERIA* (Wils.). 259.

Canvas-back.

Synonyms: *Æthya vallisneria*, *Fuligula vallisneria*, *Anas vallisneria*.

Canvas-back Duck.

Kirtland, Ohio, Geol. Surv., 1838, 166, 187.

The delight of the epicure, and therefore hunted down by every market hunter, this duck has become scarce. I have seen it twice in Lorain county in the last ten years, once when it visited the Oberlin water-works reservoir.

It appears to migrate at the same time as the Redhead, but migration dates are too few to make any positive statements possible.

39. (148.) *AYTHYA MARILA* Linn. 256.

Greater Scaup Duck.

Synonyms: *Fulix marila*, *Fuligula marila*, *Aythya marila ne-arctica*.

Greater Black-head, Big Black-head, Blue-bill, Broad-bill, Raft-duck, Flocking Fowl, Shuffler, American Scaup Duck.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

In my experience this Scaup Duck is about one-fourth as numerous as the Lesser Scaup; that would make it hardly common. There is often one or two of this species in the flocks of Lesser Scaups which visit the Oberlin water-works reservoir every year. There is no evidence that this species breeds within the state. The birds which may be found on the reservoirs during the summer, while they may be of both sexes, are not breeding, but are no doubt wounded birds unable to migrate. Their bodily condition would make breeding out of the question.

The migrations are rather late, occurring late in March or early in April, and continuing for two or three weeks. In

the autumn they begin in late October and continue well toward the close of November, or later if the conditions be favorable.

40. (149.) *AYTHYA AFFINIS* (Eyt.). 25. 7

Lesser Scaup Duck.

Synonyms: *Fulix affinis*, *Fuligula affinis*.

Lesser Black-head, Little Black-head, Little Blue-bill.

Audubon, B. Am., VI, 1843, 316.

This is probably the most familiar duck to residents of Ohio. It is apparently less numerous than the Pintail, but is far less wary and so more frequently seen by the casual bird student or hunter. It seems to prefer the smaller waters, and is a regular and numerous visitor to the Oberlin water-works reservoir. It is a rare summer resident in Lorain county, and has been reported as breeding in Summit county. It probably breeds sparingly in the northern third of the state. Considerable numbers of both sexes of this species were found during the summer on both the Licking and Lewiston reservoirs, but they proved to be crippled birds and were not breeding.

The migrations begin late in March or early in April, and flocks of considerable numbers are seen at Oberlin as late as May 5th. Their return is dependent in large measure upon the weather. The first are usually seen during the second week in October, and some may tarry well into November.

41. (150.) *AYTHYA COLLARIS* (Donov.). 258.

Ring-necked Duck.

Synonyms: *Fulix collaris*, *Anas collaris*, *Fuligula collaris*, *Fuligula ruftorques*.

Ring-bill, Ring-billed Black-head, Ring-necked Scaup Duck, Marsh Blue-bill.

Kirtland, Ohio Geol. Surv., 1838, 166, 186.

This duck is little known, and is reported as rare throughout the state. Dr. Wheaton reported it as abundant. I have found it but once in Lorain county, and that once on

the Oberlin water-works reservoir. It appears to migrate with the other members of its genus, but there is no evidence that it breeds within the state.

42. (151.) *CLANGULA CLANGULA AMERICANA* (Bonap.).
261.

American Golden-eye.

Synonyms: *Clangula glaucium americana*, *Bucephala clangula*, *B. americana*, *Clangula americana*, *C. glaucium*, *Glaucionetta clangula americana*, *Fuligula clangula*.

Golden-eyed Duck, Whistler, Garrot, Great-head, Whistle-wing.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

The Golden-eye is hardly common regularly, and frequently rare. It sometimes appears in considerable numbers on the rivers and lakes, and may sometimes be found on the larger ponds. It may remain during the winter in favorable localities under favorable conditions. It has not been seen on Lake Erie during the entire winter, but sometimes remains into January. It does not breed in the state.

The Golden-eye is one of the earlier migrants in spring and later in autumn, migrating with the Mallard and Pintail.

43. (152.) *CLANGULA ISLANDICA* (Gmel.). —
Barrow Golden-eye.

Synonyms: *Glaucionetta islandica*, *Anas islandica*.

Rocky Mountain Garrot or Golden-eye.

McCormick, Auk, 1892, 397.

If one could judge from the records, this is an almost unknown bird in Ohio. It is reported from Sandusky Bay, by Prof. E. L. Moseley, and has been taken twice in Lorain county, once by Mr. L. M. McCormick (see above reference) and once by the writer, on the Oberlin water-works reservoir. It should be found during the winter on the waters of the northern part of the state.

44. (153.) CHARITONETTA ALBEOLA (Linn.). 262.
Buffle-head.

Synonyms: *Clangula albeola*, *Bucephala albeola*, *Fuligula albeola*, *Anas albeola*.

Buffle-headed Duck, Butter Duck, Butter-ball, Dipper, Spirit Duck, Dipper Duck, Butter-box, Hell-diver.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

The little Buffle-head is common during the migrations, both spring and autumn. It visits the smaller lakes and ponds, where it is oftener seen than on larger waters. It is not wary, trusting to its agility in diving for protection. There is no likelihood that it breeds within the state, but it may remain all winter in suitable localities well south.

Its migrations occupy the last week in March and the first two weeks in April. It appears to be less common during its southward migration, which begins early in October and continues well into November, or later.

45. (154.) HARELDA HYEMALIS (Linn.). 263.
Old-squaw.

Synonyms: *Harelda glacialis*, *Anas glacialis*, *A. hyemalis*, *Clangula hiemalis*, *C. hyemalis*.

Long-tailed Duck, Old-wife, South-southerly.

Wheaton, Ohio Agri. Report, 1860, 370, 378.

This is a winter duck, sometimes passing to the southern border of the state. It is not at all regular even in the northern part, and does not appear to be governed wholly by weather conditions. During some winters it is decidedly numerous anywhere on the lake front, and may venture well inland upon the smaller lakes and reservoirs, to the Ohio river, and several winters may pass without another visitation. Specimens have been taken from the gill nets off Lorain in five fathoms of water where they had dived for fish and became tangled in the nets and drowned. Several spent the winter of 1901-02 on the lake shore in Lorain county.

46. (160.) *SOMATERIA DRESSERI* Sharpe. —.
American Eider.

Synonyms: *Somateria mollissima dresseri*.

Davie, Nests and Eggs of N. Am. Birds, 1898, 92.

The specimen here reported by Mr. Davie was captured at the Licking reservoir, November 11, 1895, by Mr. William Harlow. The specimen is a female and is preserved in the private collection of Mr. Davie.

The fact that this species has been found a number of times well inland makes it necessary to regard it a casual rather than an accidental visitor to the state.

47. (162). *SOMATERIA SPECTABILIS* (Linn.). 264.
King Eider.

Synonyms: *Anas spectabilis*.

Wheaton, Ohio Agri. Report, 1860, 370, 378.

I have been unable to find any later records for the occurrence of this species in Ohio than those given by Dr. Wheaton in his catalogue of 1882, 535. They are: An immature bird taken at Sandusky bay (?), by Dr. Langdon during the winter of 1877-8; one found in the Columbus market, November 4, 1880, by Dr. Wheaton; and the statement that a specimen was taken at Sandusky bay and one at Cleveland "many years since," on the authority of Mr. R. K. Winslow.

48. (163). *OIDEMIA AMERICANA* Swains. 265.
American Scoter.

Synonyms: *Oedemia americana*.

American Black Scoter, Sea Coot, Butter-billed Coot, Hollow-billed Coot.

Merriam, Trans. Conn. Acad., IV, 1877, 127.

There seem to be four records of the occurrence of this species in the state. Licking reservoir, December, 1876, in Dr. Theodore Jasper's collection in Columbus; taken on Portage river by Mr. R. K. Winslow; one taken from a flock of three on Lake Erie, by Mr. H. E. Chubb; Alum

Creek, Columbus, December 3, 1895, in the collection of Oliver Davie, Columbus.

It seems pretty clear that this is a casual winter visitor.

49. (165.) *OIDEMIA DEGLANDI* Bonap. 266.

White-winged Scoter.

Synonyms: *Melanetta velvetina*, *Ædemia fusca* (var.?) *velvetina*, *Ædemina fusca*.

Velvet Scoter, White-winged Surf Duck, White-winged Coot, Black Surf Duck, Velvet Duck, Sea Coot

Wheaton, Ohio Agri. Report, 1860, 370, 378.

Dr. Wheaton states that Mr. R. K. Winslow recorded the occurrence of this duck at Cleveland and Sandusky bay. The records which are based upon specimens captured are: one taken on the Scioto river near Columbus, and an immature bird taken at the Licking reservoir in December, 1876, both specimens having been examined by Dr. Wheaton. There are two specimens in the Oberlin College collection, one taken April 27, the other May 3, 1892, by Harry Warden, of Lorain. These specimens were taken at Lorain.

One might judge from these records that this scoter is a rare migrant across the state, or possibly a winter visitor. It is rare at any rate.

50. (167). *ERISMATURA JAMAICENSIS* (Gmel.). 267.

Ruddy Duck.

Synonyms: *Erismatura rubida*, *Fuligula rubida*, *Anas rubida*. Black Jack, Bristle-tail, Fool Duck.

Kirtland, Ohio Geol. Surv., 1838, 166, 186.

My experience with this small duck proves that at Oberlin it is almost as numerous as the Bufflehead on the waterworks reservoir. It is seen there regularly every spring and autumn in twos and fours, rarely more, and is even less wary than the Bufflehead. There is no evidence of the breeding of this species in the state. It is reported as not common by most observers. It is probably somewhat local in its distribution.

They reach Oberlin about the middle of April and may linger until the 10th of May. The return is early in October and some remain a month or six weeks.

Subfamily ANSERINÆ. Geese.

There are six species of geese in the state, none of them really common now, none of them breeding here. They are much more terrestrial than any of the ducks, feeding upon grains and the green herbage. In the water they feed like river ducks (by tipping up, searching the bottom of a shallow pool for the roots and fruit of aquatic plants). They fly in regular order with a leader.

51. (169.) CHEN HYPERBOREA (Pall.). 243 (part).
Lesser Snow Goose.

Synonyms: *Chen hyperboreus*, *Anser hyperboreus*, *Chen hyperboreus albatrus*.

Alaska Goose, White Brant.

There is no published record of this species as an Ohio bird. Reports give it as rare in Allen, Erie, Hamilton, and Perry counties. Everywhere it is reported as rare, and as usually occurring in company with the other species.

52. (169a.) CHEN HYPERBOREA NIVALIS (Forst.). 243
(part).
Greater Snow Goose.

Synonyms: *Chen hyperboreus*, *Anser nivalis*, *A. hyperboreus*.
Snow Goose, Alaska Goose, White Brant.

Kirtland, Ohio Geol. Surv., 1838, 166, 186.

This larger species seems to be no more common than the last. It is reported from Scioto, Pike, Perry, Hamilton, and Erie counties. These Snow Geese are too conspicuously different from the other geese to make any mistake of identification possible. It is very desirable that specimens in the collections be critically examined to determine the status of each form.

53. (169.1.) CHEN. CÆRULESCENS (Linn.). 242.

Blue Goose.

Synonyms: Anser cærulescens.

Blue Snow Goose.

Wheaton, Ohio Agri. Report, 1874, 574.

This peculiarly colored goose is not so rare as was supposed before Dr. Wheaton's catalogue called attention to it. It is not a regular visitor to any locality, but may be found anywhere in the state where there is water sufficient to sustain aquatic life and afford feeding grounds. Two were captured on the Oberlin water-works reservoir, October 28, 1896. It is a migrant across the state, the most of the records falling in October.

54. (171a.) ANSER ALBIFRONS GAMBELI (Hartl.). 244.

American White-fronted Goose.

Synonyms: Anser albifrons; A. gambelii.

Laughing Goose, Gray Brant, Speckle-belly.

Kirtland, Ohio Geol. Surv., 1838, 166, 186.

This goose is rare as a migrant across the state, but is reported as a rare winter resident in Hamilton county. Mr. Ridgway states that it frequents open fields and feeds upon the scattered grain and tender blades of growing grain. Little seems to be known of it as a bird of Ohio.

55. (172.) BRANTA CANADENSIS (Linn.). 245.

Canada Goose.

Synonyms: Bernicla canadensis, Anser canadensis.

Wild Goose, Common Wild Goose.

Audubon, Orn. Biog. III, 1835, 1.

This is the "Wild Goose" of the popular mind. In the vicinity of Oberlin it is not at all common as a migrant. Usually the season's records include one large flock during each migrating period, and possibly a single individual or two. It is resident all winter in southern Ohio, where it remains from November until April. It feeds in the open fields rather than in the water, being very much of a vege-

tarian. This goose may be domesticated with little difficulty, but measures should be taken to prevent its migration when the season approaches.

The migrations are not regular, but may begin late in February and continue well into April. Few or none are seen in autumn before the first touch of winter drives them south.

56. (172a.) *BRANTA CANADENSIS HUTCHINSII* (Rich.).
245a.

Hutchins Goose.

Synonyms: *Bernicla hutchinsii*, *B. canadensis hutchinsii*, *Anser hutchinsii*.

Lesser Canada Goose, Little Wild Goose.

Wheaton, Ohio Agri. Report, 1860, 370, 378.

Dr. Wheaton admitted this species to his list on the authority of Mr. R. K. Winslow, who stated that several specimens had been taken in Sandusky bay. No specimens seem to have been preserved. A live specimen in the possession of Mr. William Harlow, of Millersport, on Licking reservoir, has been carefully examined by Mr. W. L. Dawson, and proves to belong to this form. It was captured in the wild state and has been domesticated by Mr. Harlow.

Subfamily CYGNINÆ. Swans.

Two species of swans are found in the state, both of them during the migrations only. They are seldom seen, except when the weather conditions force them near the ground in their migrations, when flocks may be noticed during the northward movement. Such large birds, with such long slender necks, could not be expected to dive for food. They are not so undignified as to tip up, but simply immerse the head and neck to glean from the surface of the mud bottom. Their food is almost wholly vegetation, but some mollusks seem to be eaten sometimes.

57. (180.) OLOR COLUMBIANUS (Ord.). 240.
Whistling Swan.

Synonyms: Olor americanus, Cygnus americanus, C. musicus, C. columbianus, Anas columbianus.

Common American Swan, American Whistling Swan.

Kirtland, Ohio Geol. Surv., 1838, 166, 187.

During the spring of 1899 this swan was numerous in Lorain county where many were killed by hunters. It is a rare migrant in the state, seldom being seen in its passage unless stopped by stormy weather. Migration records are wanting.

58. (181.) OLOR BUCCINATOR (Rich.). 241.
Trumpeter Swan.

Synonyms: Cygnus buccinator.

Wheaton, Ohio Agri. Report, 1860, 369, 378; Reprint, 1861, 11, 20.

The Trumpeter Swan is even less numerous than the Whistling, but passes across the state in its migrations. It has been taken on Lake Erie several times within the past ten years. Very little seems to be known of it as an Ohio bird. This swan may remain in the state during the winter.

ORDER HERODIONES. Bitterns, Herons,
Storks, Ibises, Egrets.

SUBORDER CICONIÆ. Wood Ibis.

Family CICONIIDÆ. Wood Ibis.

The single species comprising this family rarely wanders to the southern part of the state.

59. (188.) TANTALUS LOCULATOR Linn. 192.
Wood Ibis.

Synonyms: American Wood Stork, Colorado Turkey, "Gannet," "Water Turkey."

Wheaton, Reprint, Ohio Agri. Report, 1861, 21.

Apparently the only absolutely unquestionable record of

this bird's occurrence in Ohio is that of Mr. H. E. Chubb, of Cleveland, who mounted a young male which was captured ten miles west of Cleveland. Dr. Langdon's inferential record should not be omitted. Specimens captured on the Whitewater river in Indiana very likely followed that river to its junction with the Big Miami and so into Ohio.

SUBORDER HERODII. Bitterns, Herons, Egrets.

Family ARDEIDÆ. Bitterns, Herons, Egrets.

Subfamily BOTAURINÆ. Bitterns.

All the species comprising this group are found in the state. They are strictly swamp hunters, feeding and nesting there. They usually stand quietly and wait for the prey to come within striking distance, when they strike it with the strong, sharp-pointed bill. I have seen them pursue the frog or fish or tadpole. Apparently they eat any small animal which comes in their way in the swamps, except birds.

60. (190.) BOTAURUS LENTIGINOSUS (Montag.). 190.
American Bittern.

Synonyms: *Botaurus minor*, *Ardea minor*, *A. lentiginosus*.

Bittern, Indian Hen, Stake Driver, Bog-bull, Thunder Pump, Kirtland, Ohio Geol. Surv., 1838, 165.

The Bittern will not be known to those who do not go into the marshes and swamps. It is seldom seen on running streams, preferring the unfrequented swamps and bogs, feeding in the stagnant pools among the reeds and brush. It is reported as fairly common over the state, but will be absent from places lacking swampy ground, and therefore must be considered local in its distribution in summer. It is more frequently seen during the migrations than at any other time. While visiting in Medina in May, 1901, while out with a party of bird students on a wet morning, we saw a Bittern in an orchard in the heart of the residence district of the village. It permitted an approach within a rod, and

even then merely hopped into the foliage a little closer. Later I learned that we failed to see the young bird which was crouching in the grass. This bird is a summer resident, probably breeding throughout the state wherever suitable places may be found.

The first reach Oberlin late in March or early in April, and the last return south late in October.

61. (191.) *ARDETTA EXILIS* (Gmel.). 191.

Least Bittern.

Synonyms: *Ardea exilis*.

Kirtland, Ohio Geol. Surv., 1838, 165.

This little bittern is more local in its distribution than the last species. At the Licking reservoir it was the most numerous of the swamp haunting birds, but we were unable to find one at the Lewiston reservoir. It nests in the Sandusky bay swamps, and a pair has usually been found at the Oak Point swamps. Elsewhere I have no knowledge of it. The birds are so reluctant to leave their reedy retreats that it is no wonder few are seen by any but the ardent ornithologist. It is likely that this bittern breeds locally throughout the state, but the reports are not positive on that point.

The migrations are late in April or early in May, and the last return south by the middle of September.

Subfamily ARDEINÆ. Herons and Egrets.

Six species of this group are found in Ohio. All of them are wading birds and therefore feed in shallow water. They choose more open water than the bitterns, trusting more to watchfulness and stalking for their food. Their nests are built in trees or bushes instead of in the rushes, and the birds are found among the trees. Their colors do not blend so perfectly with their surroundings. Their food is much the same as that of the bitterns.

62. (194.) ARDEA HERODIAS Linn. 185.
Great Blue Heron.

Synonyms: Blue Crane.

Kirtland, Ohio Geol. Surv., 1838, 165.

This, the largest of our herons, is being jostled about at an alarming rate as its wooded retreats disappear. It is a summer resident in all parts of the state, but the large heronries once accommodating great numbers of pairs are either greatly reduced or wholly destroyed. I have reports of a great heronry at Richmond, and another, already reduced to half its former size, some eight miles southeast of Jefferson. The water is being drained off and the trees made into lumber, and the birds must go. In Lorain county half a dozen pairs nest each year, but there is no apparent increase in numbers from year to year. Their nesting retreats have not yet been discovered, so they are likely to remain in peace for some time.

Unlike the bitterns, the herons prefer either running water or stagnant water free from much growing vegetation. The Great Blue feeds mostly from the fish nets in Lake Erie, taking the fish out of the "pounds." Batrachians are captured in the streams and ponds, and some grasshoppers are used to vary the diet.

The first reach Oberlin about March 20th, and the last return south about the middle of October.

63. (196.) HERODIAS EGRETTE (Gmel.). 186.
American Egret.

Synonyms: Herodias alba egretta, Ardea egretta.

Great White Egret, Great White Heron, White Crane.

Kirtland, Ohio Geol. Surv., 1838, 165, 185.

Dr. Wheaton wrote of this heron, "Rather common visitor in July, August, and September." It is now not only not common, but any record is counted worthy of special mention. Specimens have been taken in Erie, Lorain, Cuyahoga, and Ashtabula counties in recent years, besides the numerous records from counties farther south. Dr. Whea-

ton knew of no breeding records, but spoke of seeing young birds. His statements seem to indicate that he regarded the occurrence of this heron in Ohio as the result of a northward migration after the breeding season. I have been unable to find any actual breeding records. One of the two Lorain county specimens, taken by Mr. R. E. Jump, near Oberlin, was found during the spring. The majority of occurrences seem to fall in July and August.

64. (197.) *EGRETTA CANDIDISSIMA* (Gmel.). 187.
Snowy Heron.

Synonyms: *Garzetta candidissima*, *Ardea candidissima*.
Little White Egret.

Wheaton, Ohio Agri. Report, 1860, 368, 377.

The occurrence of this heron in the state nearly duplicates that just given for the American Egret. While every record is regarded as practically accidental for that county in which the record falls, it is significant that the records cover practically all of the state except the extreme northwestern and extreme southeastern parts. On the lake shore, Erie, Lorain, Lake, Ashtabula; inland, Licking, Hardin, Defiance; and Hamilton on the southwestern border are certainly representative of the whole state. With our present knowledge of this bird we must regard it as rare and irregular as a summer visitor.

65. (200.) *FLORIDA CÆRULEA* (Linn.). —.
Little Blue Heron.

Synonym: *Ardea cærulea*.

Entered as hypothetical by Wheaton, Reprint, Ohio Agri. Report, 1861, 21, and also in his 1882 Catalogue. Also as hypothetical by Langdon, Cat. Birds of Cin., 1877, 15. The first published record of this species as unquestionably a bird of Ohio is as follows:

McCormick, L. M., Auk, X, Oct., 1892, 397. Record of a bird captured near Oberlin by Mr. R. E. Jump, about 1882.

The distribution of this little heron in Ohio is hardly less irregular than that of the two egrets. Since the publication of the Lorain county specimen others have been taken in

Hamilton (Dury and C. C. Smith), Morgan (Morris and Arrick), where it was found breeding, Ashtabula (Sim), Perry (DeLong), Pike (Henninger). Reports from Columbiana and Defiance clearly refer to the Green Heron. The movements of this heron are too erratic to make predictions of its probable occurrence worth while.

66. (201.) *BUTORIDES VIRESCENS* (Linn.). 188.
Green Heron.

Synonyms: *Ardea virescens*.

Fly-up-the-creek, Shytelopeke.

Kirtland, Ohio Geol. Surv., 1838, 165.

This is the common and well-known heron in Ohio. It is common and breeds everywhere in the state where there is water enough to furnish food and trees or other cover enough to hide the nest and young. In Lorain county it frequently nests in orchards bordering swamps, or in the thick second growth on a hillside.

The Green Heron consumes quantities of grasshoppers, and probably other large insects, besides its diet of tadpoles and water insects, and small batrachians. It is too useful to be persecuted for its ungainly carriage.

The first reach the state during the last week in April, usually, and the most have gone south by the first of October, but individuals may tarry even after the middle of November where the fishing is good.

67. (202.) *NYCTICORAX NYCTICORAX NÆVIUS*. (Bodd.). 189.
Black-crowned Night Heron.

Synonyms: *Nyctiardea grisea* var. *nævia*, *Ardea discors*, *Nyctiardea gardneri*, *Ardea nævia*.

Night Heron, Quawk, Squawk, Qua-bird, American Night Heron, Night Raven.

Kirtland, Ohio Geol. Surv., 1838, 165, 184.

This heron is locally common in the state, but seems to be absent from many regions. It is a summer resident wherever it is found. Its semi-nocturnal habits probably

account for its apparent absence from many places where it should breed. It is another of the swamp loving birds, nesting in the trees and bushes which grow in the swamps or in wet places.

Migration dates are lacking. It is likely that it winters in some favorable places in the state. Observers should be on the lookout for it.

ORDER PALUDICOLÆ. Cranes, Rails, Coots, Gallinules.

SUBORDER GRUES. Cranes.

Family GRUIDÆ. Cranes.

All three of the North American cranes have been found in Ohio, one of them having wandered from the west. In general appearance the cranes show a marked resemblance to the herons, but the space in front of the eye is covered with bristles instead of being bare. While migrating they fly in long files. They are not such strict marsh haunters as the herons, but frequent uplands also. They are omnivorous feeders, often swallowing indigestible matter and disgorging it after a time. Frogs, lizards, snakes, field-mice and probably insects, and vegetable food are eaten with equal relish apparently.

68. (204.) GRUS AMERICANA (Linn.). 238.

Whooping Crane.

Synonyms: *Ardea americana*.

White Crane.

Kirtland, Ohio Geol. Surv., 1838, 165.

The reports of the occurrence of this bird come from the western half of the state, where it appears to be a rare migrant.

I find no dates of migration. Judging from the migrations in Iowa at nearly the same latitude, they should be seen passing northward in a long thin line during the last week in March and the first week in April.

69. (206.) *GRUS MEXICANA* (Müll.). 239.
Sandhill Crane.

Synonyms: *Grus canadensis*, *Ardea canadensis*, *A. mexicana*.
Brown Crane, Southern Sandhill Crane, Common Brown Crane.

Wheaton, Ohio Agri. Report, 1860, 370, 480.

While this crane is by no means common it is rather more numerous than the preceding species. It has been found breeding at Chicago Junction, and near Toledo. The eggs taken at Chicago Junction were successfully hatched and the young reared and kept in captivity until their natural death. One of the three birds of this lot was preserved by Mr. E. E. Masterman, of New London, and is now in the Oberlin College museum. It is a fine large bird in almost perfect plumage.

The migrations should occur at the same time as those of the Whooping Crane. The cranes may be distinguished from other birds in flight by the manner of flight. After perhaps ten deliberate wing strokes there is a period of soaring flight of nearly the same duration, then another beating of the wings followed by a soaring, and so on. When the birds settle too close to the ground in this straight-away flight they circle upward by means of the same style of flight as when going straight ahead. At intervals they croak in concert, creating a disturbance that must arrest attention. In flight, legs and neck are stretched out at full length.

SUBORDER RALLI. Rails, Gallinules, Coots.

Family RALLIDÆ.

In food habits the species comprising this family agree in general. All eat seeds, tender vegetation, worms, insects, crustaceans, mollusks, and with these some rubbish. The rails and gallinules live in the swamp vegetation very largely while the coots live and feed more in the open water and are therefore more often seen. The rails are averse to leaving the cover of the grass, and will do so only when suddenly

disturbed. They are so protectively colored, and know so well how to assume protective attitudes, that they have small need to leave their covers.

70. (208.) *RALLUS ELEGANS* Aud. 231.

King Rail.

Synonyms: Fresh-water Marsh Hen, Red-breasted Rail.

Wheaton, Ohio Agri. Report, 1860, 369, 378.

Inland this does not appear to be a common bird, but in shallow ponds or lagoons near the lake it is common. It is probably a summer resident wherever it occurs in the state, nesting in the marshes.

It reaches Oberlin about the first of May, but I have no records for the southward migration.

71. (212.) *RALLUS VIRGINIANUS* Linn. 232.

Virginia Rail.

Nuttall, Man. II, 1835, 205.

This is probably the most common of the rails along the lake front where it is found in every marsh of any extent, and may even resort to wet meadows to nest. He is so sly and so hard to flush in spring that few but those who are on the lookout and know where to find him realize his presence. The nest is generally placed on a hummock formed by the roots of a bush or tuft of grass in the marsh, often without concealment. In movement this bird resembles a chicken, just as the King Rail resembles a hen. It is less common than the Sora away from the lake marshes, becoming even rare as a summer resident near our southern border.

The Virginia Rail reaches Lorain county about the first of May, and has gone south by the middle of September.

72. (214.) *PORZANA CAROLINA* (Linn.). 233.

Sora.

Synonyms: *Rallus carolinus*.

Carolina Rail, Ortolan, Crake, Carolina Crake, Common Rail. Kirtland, Ohio Geol. Surv., 1838, 165, 185.

The Sora is a fairly common inhabitant of the marshes and wet meadows wherever they occur in the state. It appears to be a little less numerous south than north. It frequently nests in wet meadows or in the tall grass bordering ditches. During the migrations it not infrequently strikes buildings or wires or other obstructions, and is either killed or hurt or dazed and is brought to notice more frequently than any of the other rails in this way. One that had been injured in the breast was found in the court of Peters Hall, Oberlin, when the building was opened in the morning. There had been no open doors or windows, nor any broken window where it might have entered. Its appearance there could not be accounted for unless it had squeezed under a door in the basement.

The Sora reaches Oberlin shortly after the first of May, according to my records. It probably arrives earlier but is unnoticed at first. I have no records of its departure southward, but since the date of capture of the one mentioned above was October 23, 1896, it seems likely that the departure is not far from that date.

73. (215.) PORZANA NOVEBORACENSIS (Gmel.). 234.
Yellow Rail.

Synonyms: *Rallus noveboracensis*, *Fulica noveboracensis*.

Yellow-breasted Rail, Upland Rail, Yellow Crake, Little Yellow Rail.

Kirtland, Ohio Geol. Surv., 1838, 165, 185.

This little rail is reported as rare in the six *counties where it has been found. There is good reason to believe that it is much more numerous than the records show, because it is both so small and so hard to flush from its reedy retreats that we almost never see it. Systematic search should reveal it in many localities where it has never been seen.

I can find no records of nests actually found within the state, but the dates upon which many specimens have been found clearly indicate that this rail breeds in the northern part of the state at least.

*Ashtabula, Cuyahoga, Erie, Hamilton, Lorain, Portage.

74. (216.) *PORZANA JAMAICENSIS* (Gmel.). --
Black Rail.

Synonyms: *Rallus jamaicensis*.

Little Black Rail, Little Black Crane.

Entered as hypothetical by Dr. Wheaton in his 1882 Catalogue on the authority of Dr. Langdon, whose record was also hypothetical. The first published record must therefore stand as follows:

Dury, Charles, *Journal Cin. Soc. Nat. Hist.*, 13, July, 1890, 97.

This specimen, one of two seen, was captured near Carthage, May 17, 1890, at Ross Lake. I find no other authentic record.

75. (218.) *IONORNIS MARTINICA* (Linn.). 235.
Purple Gallinule.

Synonyms: *Porphyrio martinica*, *Gallinula martinica*, *Fulica martinica*.

Wheaton, *Ohio Agri. Report*, 1860, 369, 378, hypothetical. The first unquestioned record seems to be as follows:

Wheaton, *Bull. Nut. Orn. Club*, II, 1877, 83. Specimen captured by Dr. Howard E. Jones, at Circleville, May 10, 1877.

The first specimen captured in the state of which we have any record seems to be that reported to Dr. Wheaton. "Dr. Hunt informs me of the capture of this species near the mouth of the Big Miami river, on March 31, 1877." "Two specimens * * * * have since been taken at Madisonville, one by the writer in the latter part of April, and another by Mr. William H. Whetsel, early in May. Mr. John W. Shorten also reports one killed May 1, at Jones' Station (about thirty miles from Cincinnati), by J. H. Kelly, Esq." (Wheaton.)

Prof. E. L. Moseley reports a specimen captured at Sandusky bay, April 28, 1896; Dr. Carl Tuttle, one which had flown against the telegraph wires and was killed, "along the lake shore," September 2, 1894 (*Auk* XII, 191).

No other records than these have come to my knowledge.

76. (219.) *GALLINULA GALEATA* (Linn.). 236.
Florida Gallinule.

Synonyms: *Gallinula chloropus*, *Crex galeata*.

Common Gallinule, Red-billed Mud-hen.

Kirtland, Ohio Geol. Surv., 1838, 165, 185.

This rather conspicuous swamp bird is fairly common over the entire state where there are marshes large enough to accommodate it. In many of the larger swamps it is almost abundant. At Licking reservoir we found it in considerable numbers. At the Sandusky bay marshes it is more than common. I have not found it at the small swamps at Oak Point. A few were to be found at Lorain before the ship yards were established there. It does not flush readily from its retreats, but makes such a disturbance when running through the reeds and grasses that it can readily be traced by sound. In the vicinity of the young it is possible to approach within studying distance of the parents.

They first reach northern Ohio about the first of May, and the last is seen about the middle of September.

77. (221.) *FULICA AMERICANA* Gmel. 237.
American Coot.

Synonyms: Coot, Mud-hen, Crow Duck, White-billed Mud-hen.
Wheaton, Ohio Agri. Report, 1860, 369.

While the Coot is more often seen than the Florida Gallinule by the casual bird student, it is not as numerous in individuals in the state. It generally visits the Oberlin water-works reservoir during both migrations, and may visit the open water and ponds in the vicinity of the lake shore at such times. If it remains all winter in the southern counties it does so rarely. It was not found breeding at either the Licking or Lewiston reservoirs, nor at Chippeewa lake, but one bird was seen by me at the Sandusky bay swamps in July. It appears to breed sparingly in our most northern marshes, but is not generally common in summer.

The Coot enters the state late in March, reaches the lake

shore soon after the first of April, and returns south again during late October.

ORDER LIMICOLÆ. Shore Birds.

The Shore Birds very largely subsist on such animal food as may be found in the soft mud or along the borders of streams and ponds or on the shore of lake or ocean. All species found in Ohio except the Plovers probe the mud for the worms, insects and their larvæ, mollusks and other small animals found there, but the Plovers glean mostly from the surface and may also take some vegetable matter. They are decidedly useful birds, keeping in check insects which other birds would not destroy.

Family PHALAROPODIDÆ. Phalaropes.

Two of the three species of this family are found in Ohio, and the other one may yet be discovered. At best they are unusual and wary, wading in the water and swimming on its surface with ease.

78. (223.) PHALAROPUS LOBATUS (Linn.). 227.
Northern Phalarope.

Synonyms: *Lobipes hyperboreus*, *Phalaropus hyperboreus*,
Tringa lobata.
Red-necked Phalarope.

Kirtland, Am. Journal Sci. and Arts, XL, 1841, 21.

I have been unable to add any records of this species to those given by Dr. Wheaton, which are as follows: A single specimen (not a pair) taken near the pier in Cleveland harbor in November, 1840 (?), and preserved in Dr. Kirtland's collection. A pair taken by Dr. Jasper, on the Scioto river, also in winter plumage, one of them preserved in Dr. Wheaton's, the other in Oliver Davies' collection. Dr. Wheaton also remarks that others have been taken by Mr. R. K. Winslow and others on the lake shore. The status of the species as an Ohio bird must rest upon the three captured specimens.

79. (224.) *STEGANOPUS TRICOLOR* Vieill. 228.
Wilson Phalarope.

Synonyms: *Steganopus wilsoni*, *Phalaropus wilsonii*, *Phalaropus tricolor*.

Kirtland, Ohio Geol. Surv., 1838, 165, 185.

This phalarope is reported only from Erie county where it is stated it may breed. It has been found in Lorain county three times, each time during the first week in May. While it may breed in the north-western part of the state there is no record of its doing so.

The few notes upon its migration seem to indicate that it reaches the northern counties soon after the first of May. A more careful search for this interesting bird should discover it in many places where it is not known at present. It is wary and difficult to approach.

Family RECURVIROSTRIDÆ. Avocets and Stilts.

Both North American members of this family have been found in the state. They are also rare, and, like the last family, are waders. They do not swim as well, since their toes lack the lobes on their sides.

80. (225.) *RECURVIROSTRA AMERICANA* Gmel. 229.
American Avocet.

Kirtland, Ohio Geol. Surv., 1837, 166 185.

The rarity of this species in the state is attested by the paucity of reports of its occurrence. Dr. Wheaton placed it upon his list on the authority of Dr. Kirtland, who reported specimens that had been killed near Cincinnati by sportsmen. Mr. Charles Dury makes this later record, "Has been seen on sandbar of Ohio river." Mr. A. Hall "saw a specimen taken near Cleveland." Rev. W. L. Dawson informs me of a specimen secured at St. Mary's reservoir, Nov. 10, 1882, by Mr. Clemens Utter, which is now in the collection of the State University. Mr. R. W. Smith reports "One specimen, in winter plumage, taken at Lebanon

reservoir, in the spring of 1880, and now in Mr. Gould's collection."

This exhausts what we know of the Avocet as an Ohio bird.

81. (226.) *HIMANTOPUS MEXICANUS* (Mull.). 230.
Black-necked Stilt.

Synonyms: *Himantopus nigricollis*, *Charadrius mexicanus*.
Stilt, Long-shanks, Lawyer.

Langdon, Journal Cin. Soc. Nat. Hist., I, 1879, 182.

The above citation rests upon the authority of Mr. Dury. Dr. Wheaton also states that "The Stilt has been repeatedly taken on Lake Erie, as I am informed by Mr. Winslow." There are no more recent records.

Family SCOLOPACIDÆ. Snipes, Sandpipers, etc.

Ohio is credited with twenty-seven members of this varied family. The Woodcock is strictly sylvan, found nowhere but in the wet woods. Many are shore haunters, some feed in wet meadows, and most of them are likely to be found in or around the field ponds and spring flooded places where the water stands for a few days or weeks. All have sensitive bills with which they are able to feel the worm or insect in the mud, and some are able to move the tip of the bill without moving the rest of the bill. Some travel in flocks of varying size while some are solitary. Reference to the individual species will discover other points which it would not be possible to treat here.

82. (228.) *PHILOHELA MINOR* (Gmel.). 200.
American Woodcock.

Synonyms: *Scolopax minor*.

Bog-sucker, Big Mud Snipe, Big-headed Snipe, Blind Snipe, Whistling Snipe, Timber Doodle, Bog Bird, Night Partridge, Night Peck, Hookum Pake, "Pewee," Labarador Twister, Whistler.

Kirtland, Ohio Geol. Surv., 1838, 165.

The Woodcock is too much sought after and therefore

too well known as a game bird to pass unnoticed in any locality. It is generally reported as being a fairly common breeding bird throughout the state. Naturally it is more numerous in wet or damp woods than elsewhere, and may become even abundant in restricted localities which afford it both cover and abundant food. Being semi-nocturnal, it must be flushed to be seen during the day. At twilight one may be favored with the so-called song and peculiar mazy dancing flight during the mating season, in regions where the birds are numerous.

Woodcock is the only woods-haunting bird which probes deep into the mud for the worms and insect larvæ which lurk there. It therefore performs an office as an insect destroyer which is shared by no other bird. As its name implies, it is strictly sylvan, seldom venturing out of the brushy retreats except to pass from woods to woods, or during the mating flight.

One would naturally expect a bird which depended upon mud-inhabiting insects for food to tarry south until warm weather insured an abundant supply of its food; but the Woodcock reaches Oberlin during the last week in March at the latest, often by the middle of that month, and does not return south until early November.

83. (230.) *GALLINAGO DELICATA* (Ord). 201.
Wilson Snipe.

Synonyms: *Gallinago wilsoni*, *G. media wilsoni*, *Scolopax wilsonii*, *S. delicata*.

American Snipe, Jack Snipe.

Kirtland, Ohio Geol. Surv., 1838, 165.

The Jack Snipe is still an abundant migrant in some localities, but is becoming scarce in others. It is the mud prober of the fields and treeless bottom lands, complementing the work of the Woodcock. There can be no doubt that this snipe does good service for the farmer in ridding his wet fields of the insect larvæ which burrow there ready for the young crop soon to appear. It is a pity that the erratic flight of the snipe offers so many temptations to the sportsman,

and his flesh to the epicure. He is a necessary factor in the economy of agricultural science.

Reports of the breeding of this species in several counties pretty clearly indicate mistaken identification of the bird. So far as I have been able to judge, there are still no authentic records of nests or young actually found in the state. It may yet be found breeding in the north-western counties, and possibly elsewhere.

There is unmistakable evidence that this snipe sometimes winters in the state. Prof. E. L. Moseley records them in winter some miles west of Sandusky where springs prevent the freezing of the mud and water. In the southern counties there are January records which can hardly be migrating birds.

The first migrants reach Oberlin about the first of April, and some remain well into May. Their return in autumn is too irregular to make any definite statements possible, except that the last tarry well toward the end of October.

84. (231.) *MACRORHAMPHUS GRISEUS* (Gmel.). 202.
Dowitcher.

Synonyms: *Scolopax grisea*.

Red-breasted Snipe, Gray Snipe, Gray-back, Gray-backed Snipe, Long-billed Dowitcher, Brown-back.

Kirtland, Ohio Geol. Surv., 1838, 165.

Judging from the reports, it is a decidedly rare bird in Ohio. Dr. Langdon and Mr. Dury report it without comment as rare near Cincinnati, and Prof. Moseley reports it rare without comment at Sandusky. It is not mentioned by others. It has never been taken in Lorain county.

It should be looked for in April and May, and again in late July, in August and probably in September.

85. (232.) *MACRORHAMPHUS SCOLOPACEUS* (Say.). 202a.
Long-billed Dowitcher.

Synonyms: *Macrorhamphus griseus scolopaceus*, *Limosa scolopacea*.

Western Dowitcher, Red-bellied Snipe, Greater Long-neck. Wheaton, Ohio Agri. Report, 1884, 1875, 572.

There seemed to be considerable confusion in Dr. Wheaton's mind regarding the two Dowitchers, since this species was not included in the body of his catalogue, but was given a place in his check-list. It seems likely that his *M. griseus* covered this species which was then regarded as a subspecies. I have but two specific references to this species, both from Cincinnati. Mr. William Hubbell Fisher has permitted me to examine a specimen in his private collection, and Mr. Charles Dury reports it as rare. If there be other specimens in collections they have not been brought to my notice. Its normal range would seem to lie west of Ohio, although the other species is the rarer in Indiana, according to Butler.

86. (233.) MICROPALAMA HIMANTOPUS (Bonap.). 203.
Stilt Sandpiper.

Synonyms: *Tringa himantopus*.

Wheaton, Ohio Agri. Report, 1874, 1875, 572.

Dr. Wheaton admits it to his catalogue on the authority of Mr. Winslow. Mr. A. Hall enters it as "Very rare," near Cleveland. The only other record is the following: Forest and Stream, XXXIII, No. 1816, p. 265 (?). Dr. E. Sterling. 1889.

87. (234.) TRINGA CANUTUS Linn. 204.
Knot.

Synonyms: Red-breasted Sandpiper, Gray-back, Robin Snipe, May Bird, Ash-colored Sandpiper, White-bellied Snipe, Silver-back, Red-breast Plover, Beach Robin, Horse-foot Snipe, Robin-breast, White Robin Snipe, Red Sandpiper, Blue Plover.

Wheaton, Ohio Agri. Report, 1860, 380, hypothetical. The first published record of a specimen actually taken seems to be the following:

Wheaton, Ohio Geol. Surv., 1882, Vol. IV, Pt. 1, 478.

"Mr. Ed. Savage, of this city, captured a fine male, of a pair in full breeding plumage, at the Licking reservoir, May 27, 1878."

Prof. E. L. Moseley, of Sandusky, is the only contributor to report it.

88. (235.) *ARQUATELLA MARITIMA* (Brünn.). 205.
Purple Sandpiper.

Synonyms: *Tringa maritima*.

Wheaton, Ohio Agri. Report, 1860, 380, hypothetical.

Apparently the only specimen actually captured in the state is that reported by Mr. Winslow from near Cleveland, which he says was preserved in the collection of the Cleveland Academy of Sciences.

89. (239.) *ACTODROMAS MACULATA* (Vieill.). 206.
Pectoral Sandpiper.

Synonyms: *Tringa maculata*.

Grass Snipe, "Jack Snipe," Krieker.

Wheaton, Ohio Agri. Report, 1860, 369.

This distinctively field sandpiper is fairly common as a migrant in all parts of the state. It may be abundant at some times during the migrations. It travels in flocks of from half a dozen to fifty or more birds which move as one bird. In general habits these birds resemble the plovers more than the sandpipers, apparently gleaning as well as probing for food. They must be classed as true benefactors to the farmer.

The first migrants reach Oberlin about the middle of April, and some tarry into the first week of May. The first return late in July and some remain about the wet bottom-lands until the first of October.

90. (240.) *ACTODROMAS FUSCICOLLIS* (Vieill.). 207.
White-rumped Sandpiper.

Synonyms: *Actodromas bonapartii*. *Tringa bonapartii*. *Tringa fuscicollis*.

Bonaparte's Sandpiper.

Wheaton, Ohio Agri. Report, 1860, 369.

In spite of the statement by Dr. Wheaton that this sandpiper is a "not uncommon spring and fall migrant on Lake

Erie, rare in the interior of the state," there remain only the records mentioned by him in his 1882 catalogue. Dr. Wheaton found it once, "in a locality known as the 'Broom-corn' fields, near Shadeville in Franklin county, late in October, 1875." Dr. Langdon's record follows: "Two specimens, the first recorded for this vicinity, taken September 6, 1879, near Glendale, Ohio, by Mr. J. B. Porter; both were males." The records of Mr. R. K. Winslow must be discounted, in the absence of specimens.

Bird students should be on the lookout for this species, which should be found in some numbers in the state.

91. (241.) *ACTODROMAS BAIRDII* Coues. 208.
Baird Sandpiper.

Synonyms: *Tringa bairdii*.
Wheaton, Ohio Agri. Report, 1874, 572.

While this sandpiper is reported by Mr. Dury alone of all those who have handed lists to me, it cannot be as rare as that would indicate. It has been taken in Lorain county several times during its southward migration, but never in spring that I am aware of. It should be found in some numbers with the other sandpipers. Probably the whole trouble is that none know the bird in the field. The winter plumage is not as distinctive as one could wish, but identification is not difficult.

92. (242.) *ACTODRAMAS MINUTILLA* (Vieill.). 209.
Least Sandpiper.

Synonyms: *Tringa minutilla*, *T. wilsonii*.
Kirtland, Ohio Geol. Surv., 1838, 165.

The Least Sandpiper usually reaches Oberlin in flocks after May 10. It is easily approached and readily identified, yet few seem to know it. I have always found it along the borders of ponds probing in the mud, or bathing in the water's edge. It was found in considerable numbers by Mr. Dawson and myself on Middle Bass Island during the first week in August, 1901. I have not seen it in the southward migration in Lorain county.

93. (243a.) *PELIDNA ALPINA PACIFICA* (Cous). 210.
Red-backed Sandpiper.

Synonyms: *Tringa alpina* var. *americana*, *Pelidna alpina americana*, *P. pacifica*, *Tringa schinzii*.

American Dunlin, Black-breast, Black-bellied Sandpiper, Ox Bird.

Kirtland, Ohio Geol. Surv., 1838, 165, 185.

There has apparently been a considerable decrease in the numbers of this species since Dr. Wheaton prepared his catalogue. It is nowhere given as common in the state. It is rare in Lorain county at any time of year, but has been recorded more often in the autumn than during the spring migrations. It is strictly a migrant across the state.

Migration dates are too few to be of service in determining the time of migration, but they indicate a northward movement during late April or early May, continuing well toward the close of May; and a return late in September or early October.

94. (246.) *EREUNETES PUSILLUS* (Linn.). 211.
Semipalmated Sandpiper.

Synonyms: *Ereunetes petrificatus*, *Tringa pusilla*.
Peep.

Wheaton, Ohio Agri. Report, 1860, 369.

This and the Least Sandpiper might easily be confused by any one not familiar with the two species. The difference in size would hardly be apparent unless the birds were near together. It is reported generally as not common during the migrations, but may be in some localities during favorable seasons. They often mingle with the Least Sandpipers in the fall at the common feeding-grounds of the shore birds. Both species, with many others, were recorded at the lagoon on Middle Bass Island during the first week of August, 1901, by Mr. Dawson and myself.

They appear to migrate somewhat earlier than the Least Sandpipers, in spring, but may return with them.

95. (248.) *CALIDRIS ARENARIA* (Linn.). 212.
Sanderling.

Synonyms: *Tringa arenaria*.

Ruddy Plover, Beach-bird.

Wheaton, Ohio Agri. Report, 1860, 480.

This light colored sandpiper is often common along the lake shore during both migrations. It appears to be less common in the interior of the state, but should be found on the gravelly beach of lake or large pond or reservoir. In flight the flocks are compact and move as one bird. I saw eleven killed from a flock of less than thirty birds with one discharge of the shot-gun. I have never seen the birds except in flocks of from six to fifty individuals.

The food consists largely of the insects washed ashore by the waves, and any other fragments of animal matter which the birds care for. They seldom run out on the beach far from the water, but depend largely upon the waves for food.

It passes through Lorain county during May, rarely tarrying into the first week of June, and returns by the middle of August, remaining well toward October.

96. (249.) *LIMOSA FEDOA* (Linn.). 213.
Marbled Godwit.

Synonyms: *Limosa fœda*, *Scolopax fedoa*.

Great Marbled Godwit, Doe Bird, Dough Bird, Marlin.

Kirtland, Ohio Geol. Surv., 1838, 165, 185.

I am able to add nothing to Dr. Wheaton's records of this bird in the state. "Dr. Kirtland notes its capture in several instances in northern Ohio. Mr. Langdon states on the authority of Mr. Dury, that thirty-three were 'shot in one day, near the mouth of the Little Miami, some years ago, by Charles Weeks, Esq.' A specimen was taken by a son of Dr. Jasper in the immediate vicinity of this city (Columbus), April 21, 1879." The wariness of the shore birds and the absolute necessity of securing specimens of most of them to make the identifications sure, are reasons which make the records of so many so unsatisfactory.

97. (251.) LIMOSA HÆMASTICA (Linn.). 214.
Hudsonian Godwit.

Synonyms: Scolopax hæmastica.

Smaller Doe-bird, American Black-tailed Godwit, Ring-tailed Marlin.

Kirtland, Ohio, Geol. Surv., 1838, 165, 185.

The records which Dr. Wheaton gives for this species are all that I have been able to find. "Dr. Kirtland notes its capture in the vicinity of Cincinnati, and Mr. Winslow mentions its occurrence near Cleveland. I met a flock of eight birds, in the spring of 1858, wading in a shallow pond in an old brickyard within the city (Columbus) limits, but was not so fortunate as to secure specimens. In the spring of 1861 a fine specimen was taken below the State dam, near the city, by a sportsman and taxidermist, which was preserved until recently." There appear to have been but two specimens actually captured in the state. We should make a better record than this for Ohio.

98. (254.) TOTANUS MELANOLEUCUS (Gmel.). 215.
Greater Yellow-legs.

Synonyms: Scolopax melanoleuca, Gambetta melanoleuca, Totanus vociferus.

Greater Tell-tale, Greater Yellow-shanks, Long-legged Tattler, Stone-snipe.

Kirtland, Ohio, Geol. Surv., 1838, 165.

Fairly common during the migrations over the entire state. It may be absent from some restricted localities where there are no ponds or wet meadows to furnish feeding places. Both Yellow-legs feed standing "knee" deep in the water, often immersing the entire head, but oftener darting about and thrusting here and there for some fleeing insect or tadpole. While they are not distinctly beneficial they are certainly not harmful to agricultural interests. They may often be seen in small flocks of about a dozen or less individuals, or singly on the borders of ponds of almost any extent, or on the lake shore.

This species reaches Oberlin about April 20th, and often tarries well into May. It returns again about the middle of September and remains a month. Rev. W. F. Henninger has a record for March 14, 1899, which is certainly early for the species, for southern Ohio.

99. (255.) *TOTANUS FLAVIPES* (Gmel.). 216.

Yellow-legs.

Synonyms: *Scolopax flavipes*, *Gambetta flavipes*.

Lesser Tell-tale, Common Yellow-legs, Lesser Yellow-shanks.
Kirtland, Ohio Geol. Surv., 1838, 161.

Judging from my own experience, this is the commoner form of this genus in northern Ohio at least. It is found in the same situations as the larger species, and frequently associates with it, while feeding, but seems to prefer to fly only with its own kind. I have seen companies of fifteen to twenty birds, in the ratio of two of the Greater to three of the Lesser Yellow-legs, feeding together, in starting up from the pool immediately separate, each species flying by itself.

Rev. W. F. Henninger has a record for southern Ohio on March 18, 1901. This is undoubtedly the earliest record for the appearance of this species for the state. The average date of arrival at Oberlin falls close to the first of May. This may be too late, since there are records for the middle of April. The southward movement begins early in August and continues to the end of September.

100. (256.) *HELODROMAS SOLITARIUS* (Wils.). 217.

Solitary Sandpiper.

Synonyms: *Totanus solitarius*, *T. chlorypigi*us. *Rhyacophilus solitarius*, *Tringa solitaria*.

American Green Sandpiper, Solitary Tattler, Wagtail, Tip-up.
Kirtland, Ohio Geol. Surv., 1838, 165.

As its name implies, this bird is solitary in its habits, and does not occur in flocks. It clearly prefers a small pond in the borders of some open woods, or in the midst of a pasture in which there remain scattering trees. It may also be

found in more open situations during the migration period, rarely loosely associated with Yellow-legs. I have never seen it in merely damp places, but it sometimes frequents small temporary streams which run through meadows. There seems good evidence that this sandpiper breeds sparingly from the vicinity of Columbus northward. I have seen individuals in each summer month. Dr. Wheaton found a young bird in the care of its parents near Columbus. The ease with which this species may be confounded with the Spotted Sandpiper may account for its apparent absence during the summer. It has the general appearance, and a note which closely resembles that of the Spotted Sandpiper, but lacks the round spots on the underparts, and has white spots on its back. The white spotted back should positively separate it from the Spotted Sandpiper, and its note should be equally distinctive from the Yellow-legs which also has white dorsal spots.

This sandpiper reaches Oberlin during the third week of April, and returns south rather late in October.

101. (258.) *SYMPHEMIA SEMIPALMATA* (Gmel.). 218.
Willet.

Synonyms: *Totanus semipalmatus*, *Scolopax semipalmata*.
Semipalmated Tattler.

Kirtland, Ohio Geol. Surv., 1838, 165.

Besides Dr. Wheaton's records, Dr. Langdon and Mr. Dury are the only ones who report this species. It has not been taken in Lorain county. Dr. Wheaton's statement, clearly based upon Dr. Kirtland's information, that it is "Not a common spring and fall migrant, probably breeds in northern Ohio," indicates that since 1838, when Dr. Kirtland found it in summer on the lake shore, it has become not only rare but almost extinct. If it still occurs near Cincinnati it is very rarely. Observers should watch carefully for the birds and report any occurrences.

102. (261.) *BARTRAMIA LONGICAUDA* (Bechst.). 220.
Bartramian Sandpiper.

Synonyms: *Actiturus bartramius*, *Totanus bartramius*, *Tringa bartramia*, *Tringa longicauda*.

Upland Plover, Bartram's Tattler, Field Plover, Grass Plover, Prairie Pigeon, Prairie Snipe.

Audubon, Orn. Biog., IV, 1838, 24.

This large upland sandpiper is fairly common during the entire summer over the greater part of the state, being rather less common along our southern border as a summer resident. While a few breed in the vicinity of Oberlin each year, the individuals are so few that they might easily be counted and their breeding places located. These birds are rather gleaners than probers, and therefore feed upon the insect life at the surface of the ground and among the grass, doing good service in meadows.

The average appearance for Oberlin is April 15, and the average date of last seen October 15. Rev. W. F. Henninger has a record for March 21, 1902, for southern Ohio. The birds leave the state about October 25.

103. (262.) *TRYNGITES SUBRUFICOLLIS* (Vieill.). 221.
Buff-breasted Sandpiper.

Synonyms: *Tryngites rufescens*, *Tringa subruficollis*, *T. rufescens*.

Kirtland, Ohio Geol. Surv., 1838, 165.

"Rare migrant, only noted in the fall. In addition to its occurrence noted by Dr. Kirtland (Cleveland, two specimens captured in August, 1840), it has since been taken on several occasions near Cleveland. A specimen was taken in the immediate vicinity of this city, August 31, 1876, which is now in the collection of the Ohio State University. This bird was in company with Semipalmated Plover and Semipalmated Sandpipers, on a gravelly bank of the Scioto river." (Wheaton, 1882.) Nothing more has been reported concerning this species.

104. (263.) *ACTITIS MACULARIA* (Linn.). 222.
Spotted Sandpiper.

Synonyms: *Tringoides macularius*, *Totanus macularius*, *Tringa macularia*.

Sandpiper, Spotted Tattler, Peet-weet Wag-tail, Tip-up, Teeter-tail, Sand-lark.

Kirtland, Ohio Geol. Surv., 1838, 165.

This is the common little sandpiper throughout the state. No one who has walked by a lake shore or along the margins of any considerable stream or moderate to large pond, can have failed to see this bird. It is common everywhere all summer, breeding in fields or on the steep banks of lakes and rivers. Only once have I failed to find it on the lake shore in summer, gleaning among the debris thrown up by the waves. I have also watched it gleaning in the meadows and plowed fields.

The first reach Oberlin about April 17th, and the last are seen during the first week of September. These dates do not vary materially from those for southern Ohio contributed by Rev. Mr. Henninger.

105. (264.) *NUMENIUS LONGIROSTRIS* Wils. 223.
Long-billed Curlew.

Synonyms: Sickle-bill.

Kirtland, Ohio Ohio Geol. Surv., 1838, 165, 185.

The reports indicate that this rather conspicuous bird is rarely seen within the state, but the places of occurrence are so well scattered that it may be expected to occur occasionally over practically the whole of the state except the southeastern fifth. Dr. Wheaton records specimens taken near Cleveland by Dr. Kirtland; at Licking reservoir, specimens captured there having been examined by Dr. Wheaton, and the probability of its occurrence at St. Mary's reservoir; and Dr. Langdon's records of several specimens taken near Cincinnati. To these may be added Defiance (Slocum), Erie (Moseley), and an additional record of a flock of seven at Licking reservoir, May 31, 1902, recorded by the writer and Mr. Irving A. Field. While it is possible

that this species may be found breeding in some parts of the state, no positive record has yet been made to that effect.

It is likely that the birds arrive from the south about the middle of April, tarrying well toward June as the records prove. They might be mistaken for the Bartramian Sandpiper when so far away that the extremely long curved bill cannot be seen, but otherwise they should be easy of identification.

106. (265.) *NUMENIUS HUDSONICUS* Lath. 224.
Hudsonian Curlew.

Synonyms: Jack Curlew, Short-billed Curlew, American Wimbrel.

Kirtland, Ohio Geol. Surv., 1833, 165, 185.

Dr. Wheaton gives practically the same records for this curlew as for the Long-billed. Records from Defiance (Slocum), Erie (Moseley), and Ashtabula (Sim) have come to me. This species was regarded as less likely to occur than the preceding, by Dr. Wheaton. So far as the reports received are concerned it would appear to be scattered over the state about the same. It is strictly a migrant in the state. Dr. Wheaton had never seen it in Ohio.

107. (266.) *NUMENIUS BOREALIS* (Forst.). 225.
Eskimo Curlew.

Synonyms: *Scolopax borealis*.
Esquimaux Curlew, Dough-bird.

Wheaton, Ohio Agri. Report, 1860, 380, 480.

Dr. Wheaton's statement that it is a "Not common spring and fall migrant" seems to be pretty largely based upon a report from Mr. R. K. Winslow that "it is not rare in the vicinity of Cleveland," without specimens to prove the statement. Dr. Wheaton records only the capture of a specimen taken near Cincinnati by Mr. Shorten, in September, 1878, but states that he saw a single bird in a flock of Golden Plovers in the vicinity of Columbus. Prof. E. L. Moseley reports it as rare in Erie county as seen by Dr. Graffe. The similarity of this and the last species makes

any records other than those of actual captures of questionable value. Fortunately we have a specimen taken within the state.

Family CHARADRIIDÆ. Plovers.

The Plovers have short beaks which are not fitted for probing in the mud, but for gleaning from the surface. They wade some, but seem to prefer to keep near the edge of the water. They have a strong tendency to flock, but may also be found singly, even during the migrations.

108. (270.) *SQUATAROLA SQUATAROLA* (Linn.). 195.
Black-bellied Plover.

Synonyms: *Squatarola helvetica*, *Charadrius helveticus*, *C. squatarola*, *Tringa squatarola*, *T. helvetica*.

Swiss Plover, Bull-head Plover, Whistling Field Plover, Ox-eye, Beetle-head.

Kirtland, Ohio Geol. Surv., 1838, 165, 185.

This plover appears to be rare throughout the state. It has not been generally reported, but such reports as have been made indicate that it may be found occasionally everywhere except in the south-eastern fifth. Its migrations begin about the middle of April and may continue well toward June. In the autumn they should be found in August and September.

109. (272..) *CHARADRIUS DOMINICUS* Müll. 196.
American Golden Plover.

Synonyms: *Charadrius fulvus* var. *virginicus*, *C. pluvialis*, *C. virginicus*, *C. fulvus*.

Golden Plover, Field Plover, Bull-head Plover, Bull-head, Green-back, Green Plover.

Kirtland, Ohio Geol. Surv., 1838, 165, 184.

From common or even abundant during the spring migrations up to the time Dr. Wheaton's work closed, this plover has become hardly more than casual in most sections of the state. It is still found in some numbers occasionally, in spring, in regions where the small lakes are numerous, and

sometimes on the shore of Lake Erie. Several reports to the contrary notwithstanding, it does not nest in the state. Late spring and early autumn records of many of this group of birds do not necessarily indicate that they breed in the region where such records have been made. The "Shore Birds" linger late and return early.

The Golden Plover, as well as several other species, migrates in flocks which fly as one bird. When one individual has been shot from a flock the rest return for the lost one, and may be in danger of a similar fate at the hands of a thoughtless hunter. They should be looked for about the middle of April, and again in late August or early September.

110. (273.) *Oxyechus vociferus* (Linn.). 197.
Killdeer.

Synonyms: *Charadrius vociferus*. *Ægialitis vocifera*
Killdeer Plover, Ring Plover.

Kirtland, Ohio Geol. Surv., 1838, 165.

Of all members of this group of birds the Killdeer is probably the best known, because he talks about himself so much! He is among the first birds to come from the south in early March, not seldom reaching the lake shore with the Robin and Bluebird, but more often about a week behind them. One would expect a bird of his tastes to fare poorly while snow still covers the ground for days at a time, but he seems to find enough to keep him warm and active. At first he stays close to some low, wet place, gleaning from the surface of the mud, or searches out the fields which have been well kept and therefore furnish him with a clear surface to feed upon. It seems likely that the Killdeer sometimes eats soft seeds when insects, worms, and other soft animals are difficult to find, but I have no direct evidence of it. At any rate, he must be classed with the distinctly beneficial birds because of the insect larvæ which he eats.

The first decidedly spring thaw, which may occur late in February or not till the second week in March, brings this bird to Lorain county. He stays all winter in the southern

part of the state. His stay in the autumn is determined by weather conditions, but he is usually to be found until the first of November, and sometimes well toward the close of that month.

111. (274.) *ÆGIALITIS SEMIPALMATA* Bonap. 198.
Semipalmated Plover.

Synonyms: *Charadrius semipalmatus*.

Ring-neck, Ring Plover, Semipalmated Ring Plover.

Kirtland, Ohio Geol. Surv., 1838, 168, 184.

This little plover is far more common in autumn than in spring, and Dr. Wheaton records it but once in spring at Columbus—May, 1880. It is not uncommon at the lake shore in autumn, from the last week in July until the middle of September. It often associates with Killdeer and the Sanderlings, but in flight flocks separately. It is generally seen in small flocks, but single individuals are sometimes found on the lake shore as well as on the smaller ponds. Its single black breast band easily distinguishes it from Killdeer if its smaller size does not. I have never seen it feeding except at the water's edge or among the recently thrown-up wash on the shore. Its food seems to be largely insects and small mollusks.

112. (277.) *ÆGIALITIS MELODA* (Ord). 199.
Piping Plover.

Synonyms: *Charadrius melodus*, *Ægialitis melodus*.

Ring-neck.

Kirtland, Am. Journal Sci. and Arts, XL, 1841, 24.

It seems more than likely that the A. O. U. committee will finally reduce this and the next form to one species, but in the absence of legislation it seems necessary to include both forms. The interrupted black breast band of this form and the continuous breast band of the subspecies, a difference upon which the subdivision of the species was largely based, does not seem to be a good character.

Reports of the occurrence of this small plover are meager. Dr. Langdon and Mr. Dury report it from Cincinnati, Prof.

Moseley from Sandusky, there are specimens taken in Lorain county, and the record of Dr. Wheaton for the vicinity of Columbus exhaust the records. It is certainly a rare migrant across the state, probably in late April.

113. (277a.) *ÆGIALITIS MELODA CIRCUMCINCTA* Ridgw.

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Belted Piping Plover.

Dr. Wheaton said of this form, in his 1882 catalogue, "Mr. Ridgway describes as a geographical race of this species, var. *circumcinctus*, from the Missouri region. To this variety Mr. Nelson refers the birds taken in Illinois by him, and doubtless Ohio birds are the same. But specimens of *circumcinctus* have been taken in various localities on the Atlantic coast and doubtless, as held by Mr. Brewster, the variety is untenable."

There are specimens of both forms in Ohio collections, but *circumcincta* appears to be the more numerous. Just as we go to press, Mr. W. L. Dawson, Prof. J. S. Hine and the writer have found some half-dozen pairs of this form breeding on the beach of Cedar Point, across from Sandusky, near the new Lake Laboratory of the Ohio State University. A set of four eggs was taken there, in an advanced state of incubation, June 26. This form should be found breeding in any suitable localities over the state.

Family APHRIZIDÆ. Turnstone.

The species which is found in Ohio always occurs in flocks while it is with us. I have never seen it except on the lake shore, where it was gleaning among the rubbish thrown up by the waves. It is a striking looking bird, easily identified.

114. (283.) *ARENARIA INTERPRES* (Linn.). 194.
Turnstone.

Synonyms: *Streptilas interpres*, *Tringa interpres*.

Brant Bird, Calico-black, Bead Bird, Horse-foot Snipe.
Kirtland, Ohio Geol. Surv., 1838, 165, 184.

The Turnstone appears to be little known in the interior of the state. It has been recorded at Cincinnati (Langdon), but not elsewhere away from the lake shore. It is also reported from Erie and Cuyahoga counties. It is somewhat irregular in Lorain county, but generally seen during the spring migrations in small flocks. All of my records fall between May 16 and 20. I have not seen it in autumn. While here it remains near the water's edge, gleaning from the wash of the waves. I have rarely seen it feeding on the loose sand among the larger stones a rod or more from the water. Dr. Wheaton did not find it near Columbus.

ORDER GALLINÆ. Gallinaceous Birds.

To this group belong the Game Birds par excellence. Their flesh is pleasant because they feed so largely upon vegetable matter of various kinds. Careful investigation of the food of these birds reveals the fact that the proportion of cultivated grain eaten is very small, while the weed seeds form a large proportion. There can be no doubt that of the grain eaten much is what has fallen during harvest, and so would be wasted if the birds did not get it. In some localities members of this group do eat grain to a considerable extent, but the habit is not general by any means. In winter buds and tender shoots of trees are eaten, and in summer insects are freely destroyed. There is always great danger that the birds comprising this group will suffer extinction because they are killed both for sport and for their flesh. Legislation limiting their destruction needs to be specific and not disregarded by citizens.

Family TETRAONIDÆ GROUSE, etc.

115. (289.) *COLINUS VIRGINIANUS* (Linn.). 184.

Bob-white.

Synonyms: *Ortyx virginianus*, *Perdix virginiana*, *Tetrao virginianus*.

Virginia Partridge, "Quail," Partridge.

Wilson, *Am. Orn.*, VI, 1812, 21.

Bob-white is still common in all portions of the state, but

is evidently less numerous than a score of years ago. It is reported as abundant from a few localities. The prohibitive laws have prevented any great diminution in numbers. It seems likely that the modern restrictions thrown around the sportsmen will tend to diminish their numbers or at least dampen their ardor for the chase, thereby increasing the chances of life for the "Quail." It would be a distinct æsthetic loss if the Bob-white should wholly disappear from our fields and woods. Literature is too full of references to his prophetic warning or encouragement for us to consent to his extinction.

I find no evidence that Bob-white migrates to any appreciable extent. It is probably hardly proof that he does not because a flock or covey is known to occupy the same region the year through, but it looks in that direction. Unfortunately we have almost no means of knowing for a certainty the individual birds, and so are unable to follow them all the year. It seems likely that there is some small southward movement during the colder weather, or with the appearance of considerable snow.

Dr. Sylvester D. Judd has proved that Bob-white eats very little grain, and that little is probably largely waste grain, but he does consume great quantities of weed seeds, particularly those of the ragweed. Farmers can coax a flock of Bob-whites to their barn-yards by throwing grain out to the flock, but it would be a pity to do so for the purpose of killing them.

116. (300.) *BONASA UMBELLUS* (Linn.). 182.

Ruffed Grouse.

Synonyms: *Tetrao umbellus*.

Partridge, Pheasant.

Kirtland, Preliminary Report, Ohio Geol. Surv., 1838, 67.

This strictly woods game bird has rapidly decreased in numbers in the last decade; partly because it has been so persistently hunted and partly because its breeding haunts have been destroyed in so many places. It is reported as still fairly common in the north-eastern third of the state,

and locally elsewhere, but it is rare in most other localities. None have been seen in Lorain county west of Elyria for three years. Ten years ago it was frequently met in the woods about Oberlin. It is resident where it occurs at all, remaining in the deep woods. Its drum call is familiar to every countryman.

Family PHASIANIDÆ, TURKEYS.

117. (310a.) MELEAGRIS GALLOPAVO SYLVESTRIS (Vieill.).
181.

Wild Turkey.

Synonyms: *Meleagris gallopavo* var. *americana*, *M. gallopavo*,
M. g. var. *gallopavo*, *M. fera*, *M. gallopavo fera*.

Common Wild Turkey, Eastern Wild Turkey.

Bonaparte, *Am. Orn.*, I, 1825, 80.

This, the noblest of the game birds, is all but extinct within the state. It should not be placed upon the list of extinct species until the southern counties between the Scioto river and Cincinnati have been more thoroughly worked. It may be present there still.

ORDER COLUMBÆ. Pigeons.

Of the two members of this order found in Ohio only one is now numerous enough to receive attention as regards its food. That has been done under the discussion of the species. It is noteworthy that in the eastern parts of the United States the Mourning Dove builds its nests well above the ground, almost always, but in the west on the ground, and in the middle west indifferently on the ground or above it. Of course there are exceptions in each region.

118. (315.) ECTOPISTES MIGRATORIUS (Linn.). 179.
Passenger Pigeon.

Synonyms: *Ectopistes macrura*, *Columba migratoria*.
Wild Pigeon.

Wilson, *Am. Orn.*, I, 1808, 102.

This once extremely abundant species is now of casual

occurrence during the migrations. It is likely that scattering records of single individuals or very small companies may be made from time to time. Many localities on the Western Reserve have their histories of great flights and immense rookeries. Before they have entirely passed from the memory of those who knew of them personally these places should be mapped for future reference.

119. (316.) *ZENAIDURA MACROURA* (Linn.). 180.

Mourning Dove.

Synonyms: *Zenaidura carolinensis*, *Columba carolinensis*, *C. macroura*.

Carolina Dove, Turtle Dove, Wild Dove.

Kirtland, Ohio Geol. Surv., 1838, 164.

The Mourning Dove ranks well up among the familiar birds, because it frequently nests in the orchard or shrubbery in towns and the suburbs of cities. It is a familiar bird along country roads in summer, taking dust-baths or gleaning for food. A few hardy individuals remain even in the extreme northern parts of the state all winter, but many pass the winter in the southern parts of the state. The bulk of the migrations occur about the middle of April in Lorain county. It is impossible to tell when the most go south, because they are so quiet about it. Few are seen during the molting period, which begins after the last brood is raised, and nests with eggs are found even during the first week in September.

Observations upon the food of the doves and examinations of their stomachs prove that while in spring and summer a good deal of wheat is eaten, by far the largest proportion of the dove's food consists of the seeds of noxious weeds. Undoubtedly the most of the wheat eaten is what the birds find among the stubble after the crop has been harvested. I have many times flushed doves from cornfields, during July and August, and found that they were eating the partly ripe seeds of the grasses which are the plague of the farmer's life. The Mourning Dove seldom occurs in flocks of any size, and therefore any depredations upon grain fields will hardly be noticed.

ORDER RAPTORES. Birds of Prey.

SUBORDER SARCORHAMPHI. American Vultures.

Family CATHARTIDÆ. American Vultures.

120. (325.) CATHARTES AURA (Linn.). 177
Turkey Vulture.

Synonyms: Vultur aura, Rhinogryphus aura.

Turkey Buzzard.

Wilson, Am. Orn., IV, 1812, 89.

The Turkey Vulture is fairly common during the summer throughout the state, even to the lake shore, the books upon birds to the contrary notwithstanding. During my residence at Oberlin, beginning in 1890, it has been almost common, nesting in fallen hollow logs or hollow stumps. It remains all winter in the southern parts of the state, but is absent in winter north. I have found it as early as the 7th of March at Oberlin.

Its habit of feeding on carrion is well known.

If the birds are too far away for one to see the bare head, the soaring flight without any flapping of the wings, or only an occasional stroke to regain balance, readily identifies the species. The hawks soar, it is true, but they also flap their wings a good deal, or soar in circles, while the vulture soars almost straightaway, without wing strokes.

121. (326.) CATHARISTA URUBU (Vieill.). 178.
Black Vulture.

Synonyms: Carthates atratus, C. iota, Catharista atrata, Vultur atratus.

Carrion Crow.

Audubon, Orn. Biog., II, 1834, 33.

The foregoing reference by Audubon that this species summers in Ohio as far as Cincinnati; three specimens seen by Dr. Langdon, "On or about December 20, 1876," one of which he secured on January 1, 1877, it having been killed a few days previous by Mr. Edwin Leonard, of Madisonville; and a specimen in Mr. Oliver Davie's collection, killed

February 6, 1895, four miles north of Reynoldsburg, seem to constitute the Ohio records for this southern species.

SUBORDER FALCONES. Kites, Hawks, Eagles, Falcons,
Osprey.

Family FALCONIDÆ. Same as above.

The food habits are fully given under each species.

122. (327.) ELANOIDES FORFICATUS (Linn.). 166.
Swallow-tailed Kite.

Synonyms: *Falco furcatus*, *Nauclerus furcatus*, *Falco forficatus*.
Wilson, Am. Orn., VI, 1812, 70.

Writing in 1812, Wilson said that this Kite "is very abundant in South Carolina and Georgia, and still more so in West Florida, and the extensive prairies of Ohio and the Indiana Territory." Dr. Kirtland found it "in considerable numbers in Portage and Stark counties" in the middle thirties, but noted its absence in 1838. Mr. Kirkpatrick found it occasionally in Crawford county, where it had been numerous before, in 1858. This was the last seen of this elegant bird until a specimen came into Dr. Wheaton's hands from Pataskala, where it was killed August 22, 1878. Twenty years later in August, 1898, Rev. W. F. Henninger notes a specimen shot in Ross county near Chillicothe. This seems to close the records to date.

123. (331.) CIRCUS HUDSONIUS (Linn.). 167.
Marsh Hawk.

Synonyms: *Circus cyaneus* var. *hudsonius*, *Falco cyaneus*, *F. hudsonius*.

Marsh Harrier, Harrier, Mouse Hawk, Blue Hawk, American Marsh Hawk.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

In habits this hawk is unlike any of the other hawks. It lives in the open country, nesting and perching on the ground. It may always be known by its white rump spot or patch, and by its relatively small body and long, pointed

wings and long tail. It flies more like a swallow than a hawk, as it skims over the meadows or sweeps upward and away with graceful, easy strokes. It is hardly common generally over the state, but is found in considerable numbers in especially favorable places.

The food of this hawk proves it to be one of the most beneficial of all our predaceous birds. It does sometimes eat poultry and small birds, but the proportion of these to the whole food of mice, snakes, insects, and squirrels is so small that it should not count against him. While their young were still in the nest I have seen the male return from a search over the meadows with a good-sized snake, apparently not yet dead, in his talons, and drop it from a considerable height to the female who would always catch it before it reached the ground.

The Marsh Hawk is not a common winter resident, even in the southern counties, and breeds but rarely if at all there. It passes north early in March, reaching the lake shore before the first of April, sometimes as early as the last week in February. It has not been found in Lorain county after the middle of October.

124. (332.) ACCIPITER VELOX (Wils.). 169.

Sharp-shinned Hawk.

Synonyms: *Accipter fuscus*, *Falco velox*, *Falco fuscus*, *Nisus fuscus*.

"Pigeon Hawk."

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

This little hawk is hardly common anywhere in the state, but it is everywhere present all the year. While it prefers the woods, skulking through the smaller growth low down if it has been feeding, it may often be seen flying across the open. In flight it may be known from the Sparrow Hawk by its larger size, long barred tail, lack of reddish in the feathers of the back, and by the fact that it does not hover over the meadows but skulks in the woods.

It lives principally upon small birds and young poultry and English Sparrows, only occasionally killing mice and

other small mammals. It is distinctly injurious, but is becoming less so in winter because it now prefers English Sparrows to other birds. It is therefore becoming more numerous in the cities and towns and less so in the country. If he will only grow fonder of the sparrow pests and leave the young poultry alone we can easily forgive the past and give him encouragement for the future.

125. (333.) ACCIPITER COOPERII (Bonap.). 168.
Cooper Hawk.

Synonyms: *Falco cooperi*, *Astur cooperi*, *Nisus cooperi*.

Chicken Hawk, Big Blue Hawk, Big Blue-tailed Hawk, Long-tailed Dart, Darter.

Kirtland, Ohio Geol. Surv., 1838, 164, 179.

This medium-sized hawk is more often found in the woods than elsewhere. Indeed, it is seldom seen out of the woods except while it is soaring up almost out of sight, or while it is making a raid upon the poultry yard. It differs from the Sharp-shinned Hawk in having a long, rounded tail and rounded instead of rather pointed wings. To one who knows these two birds there is no difficulty in identifying them, but the difference is hard to explain. In general, the Sharp-shinned gives the impression of sharp angles with its pointed wings and square cut tail, while the Cooper has a decidedly rounded outline for both wings and tail. The Cooper is a larger bird. Its metallic "tic, tic, tic, tic," is its characteristic call, usually uttered during the breeding season.

This hawk is a common resident in the southern parts of the state, but is rare in winter north of Columbus. The individuals which migrate reach Oberlin about the middle of April, and depart late in October.

Like the Sharp-shinned, this hawk lives principally upon small birds, poultry also composing a large share of its food. It occasionally eats snakes and small mammals, but distinctly prefers the hot-blooded birds. If it eats English Sparrows their numbers must be small, because it does not come into the cities and towns for them. The maledictions heaped

upon him are his death knell. We can only hope that he will not take down with him the many hawks which are distinctly beneficial, thus depriving us of Nature's balancers for the injurious rodents and larger insects.

126. (334.) ACCIPITER ATRICAPILLUS (Wils.). 170.
American Goshawk.

Synonyms: *Astur atricapillus*, *Falco palumbarius*, A. p. var. *atricapillus*.

Goshawk, Blue Hen Hawk, Chicken Hawk.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

The Goshawk is so much like the Cooper Hawk that it is not known by more than a few of the more experienced Ohio ornithologists. It is larger, with a relatively shorter tail, and the general color is bluish-slate, so much so that the bird is often called the "Blue Hawk." It is much more northern in its distribution, reaching Ohio only in winter, and then occurring over the entire state in small numbers. It seems likely that some of the northern winter records for the Cooper Hawk may really be for this species. The records of its occurrence in the state are too few to make any statement of the time when it may be expected to reach the state from the north reliable. It seems likely that it arrives with the first cold and snow.

In food habits this species resembles the Sharp-shinned and Cooper Hawks, but its larger size necessitates larger quarry. It lives principally upon birds, the grouse forms contributing the most to its bill of fare. It can easily make off with an ordinary sized chicken, which it is very willing to come into the barn-yard for. It is so bold a hunter that the presence of man seems to make no difference whatever. Many instances have been recorded when it has picked up a chicken from the ground at the feet of persons who were feeding the flock. The Ptarmigan and Ruffed Grouse are favorite tidbits in its summer home. In summing up the evidence Dr. Fisher says: "Little can be said in favor of this Hawk, as the destruction of a few injurious rodents is a very meager offset for the great number of game birds

and poultry it destroys." Fortunately it is not numerous enough in our state to inflict any appreciable damage.

127. (337.) *BUTEO BOREALIS* (Gmel.). 171.
Red-tailed Hawk.

Synonyms: *Buteo aquilinus*, *Falco borealis*, *F. aquilinus*.
Red-tailed Buzzard, Hen Hawk.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

This large hawk appears to be migratory to some extent, passing farther south in winter when the ground is covered with snow. However, it is a fairly common resident over the entire state. It is sometimes absent from the northern counties for two or three weeks during the period of snow covered ground, usually in the early part of February. It has the undeserved title of "Hen Hawk," which should be transferred to the Goshawk. While it is true that this large hawk sometimes feeds upon poultry in some regions more than in others, it clearly prefers other quarry. Dr. Fisher says, "Abundant proof is at hand to show that this Hawk greatly prefers the smaller mammals, reptiles and batrachians, taking little else when these are obtainable in sufficient numbers; but if hard pressed by hunger it will eat almost any form of animal life, such as poultry and other birds, insects, crawfish, or even offal or carrion. . . . It is to be remarked that young Hawks are less particular as to the character of their food, and they are more frequently found to be the depredators of the poultry yards." Rev. Mr. Henninger has found that in southern Ohio, at least in Pike and Scioto counties, the Red-tails feed almost exclusively upon birds and poultry.

With the evidence all in we must say that while this large hawk is sometimes a menace to the poultry yard and at such times must be killed, it is generally far more beneficial than injurious, and therefore should not be persecuted unto death whenever found.

This hawk may be seen soaring in ascending spirals almost anywhere in any region of the state on fair days. It nests in the woods, but apparently feeds as much in the open

fields as in the woods. It may be easily distinguished from the other large hawks by the bright rufous of its tail, which may have a band of dusky near the tip.

128. (339.) BUTEO LINEATUS (Gmel.). 172.

Red-shouldered Hawk.

Synonyms: *Falco hyemalis*, *F. lineatus*, *F. buteodes*.

Red-shouldered Buzzard, Winter Hawk, Chicken Hawk.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

In northern Ohio this hawk is the most numerous large hawk, the little Sparrow Hawk alone outnumbering it. It is less common during the winter than during the summer, and may be absent for three or four weeks in the latter part of January and February when the cold is severest. It seems to be much less common, if present at all, in the southern part of the state in summer. I did not see it along the Ohio river in August. It may be known from the other large hawks by the lack of any rufous on the tail and by the moderate length of its tail. Its cry is *pil ye, pil ye*, differing from the cry of the Red-tail, which is a continuous scream.

There seems to be no evidence that this hawk eats poultry. Dr. Fisher states that it eats mammals, birds, snakes, frogs, fish, insects, centipeds, spiders, crawfish, earthworms, and snails. Its food is therefore more varied than that of any other member of this order. It is distinctly beneficial, and if injurious at all so very little so that it may not be counted as cause for the death sentence except on the rarest of occasions.

The general habits of this hawk resemble those of the Red-tail, but its nest is not placed so high, usually, and it is not quite so wary.

129. (343.) BUTEO PLATYPTERUS (Vieill.). 173.

Broad-winged Hawk.

Synonyms: *Buteo pennsylvanicus*, *Falco pennsylvanicus*, *F. latissimus*, *B. latissimus*.

Broad-winged Buzzard.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

This is another little known hawk, not because it is rare, for it is present in some numbers throughout the state, but because it apparently differs but little from several other middle-sized hawks. It is about the size of the Cooper Hawk, but differs from that species in having a much shorter tail and in having the wings more slender and therefore more pointed instead of rounded. It differs from the Sharpshinned in being larger and in its habit of soaring like the other hawks of the genus *Buteo*. Perhaps the most reliable character is its unsuspiciousness of man. It will permit a near approach without manifesting either uneasiness or curiosity.

Dr. Fisher says: "The food of this hawk consists principally of insects, small mammals, reptiles, and batrachians, and occasionally of young or disabled birds. A specimen secured by the writer just after a shower was gorged with earthworms. In spring when toads frequent ponds to spawn, it devours large numbers of them, and later in the season it is a not uncommon occurrence to see an individual with a snake or frog dangling from its talons." Probably the greatest service which this hawk renders is in the destruction of large numbers of the large insect larvæ which most birds do not touch. While it eats some animals which are beneficial it is too useful a bird to be killed indiscriminately, but should be accorded protection.

This hawk should be found wintering in the state south of Columbus, but probably in small numbers. It reaches northern Ohio in the spring about the middle of March, and has gone south again by the middle of November.

130. (347a.) *ARCHIBUTEO LAGOPUS SANCTI-JOHANNIS*
(Gmel.). 174.

American Rough-legged Hawk.

Synonyms: *Falco sancti-johannis*, *Archibuteo sancti-johannis*,
A. lagopus.

Rough-legged Buzzard, Black Hawk.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

This large hawk occurs only during the winter, when it

ranges across the state. Being semi-nocturnal in habits it is not often seen by those who go out only during bright day, and so is regarded rare or absent from many regions where it undoubtedly occurs. I have found it in Lorain county only after the holidays, usually in late winter and early spring. In feeding habits it somewhat resembles the Marsh Hawk, beating low over the meadows and fields and pouncing upon the mice and moles from its low flight.

Dr. Fisher says: "Its food consists principally, if not almost exclusively, of the smaller rodents, and most prominent among them are the arvicoline mice and lemmings." It is therefore clear that this hawk should be welcomed to our fields and meadows and orchards where these pests abound.

Probably the chief character which will distinguish this large hawk from all the others in flight is its dark color. It is so much smaller than the eagles that the comparison would appeal to any one at once.

131. (349.) *AQUILA CHRYSÆTOS* (Linn.). 175.
Golden Eagle.

Synonyms: *Aquila chrysaetus* var. *canadensis*, *Falco fulvus*, *F. chrysaetus*, *Aquila canadensis*.

Ring-tailed Eagle.

Kirtland, Ohio Geol. Surv., 1858, 67, 177.

It is not at all likely that this eagle nests in the state. It seems to be a rare winter visitor, but is reported from all sections. Mr. Harry B. McConnell tells me that three have been captured in the vicinity of Cadiz within the past three years. I have four records for Lorain county within the last five years. One was shot, not far from Oberlin, in the act of carrying off a hen from a barn-yard.

"The food consists mainly of mammals and birds, of which spermophiles, rabbits, fawns, lambs, turkeys, water fowl and other large birds form the principal part, though offal and carrion are sometimes taken.

"To sum up, it may be stated that in sections of the country where rabbits, prairie dogs and gophers are abundant

the Golden Eagle is very beneficial, confining its attention mainly to those noxious animals; but in places where wild game is scarce it is often very destructive to the young of domesticated animals, and hence in such places has to be kept in check." (Fisher.)

There are many accounts of the ferocity and cruelty of this large bird of prey, some of which are probably true. It has been known to kill a good sized black-tailed deer, and in rare instances to attack a man who interfered with it while it was feeding. Even in defense of its young it is usually not courageous but an arrant coward. It is more than likely that the accounts of the capture of children by this bird are good illustrations of vivid imagination. While a hungry bird might pounce upon an unprotected infant it is extremely unlikely that a child old enough to walk would be molested.

132. (352.) *HALIÆTUS LEUCOCEPHALUS* (Linn.). 176.
Bald Eagle.

Synonyms: *Falco leucocephalus*, *F. washingtonianus*, *F. washingtonii*.

White-headed Eagle, Bird of Washington.

Wilson, *Am. Orn.*, IV, 1812, 890.

While the Bald Eagle is common near Sandusky and among the islands north of there, it is rare in the other parts of the state. It does not seem to migrate southward in winter, but is strictly resident wherever it occurs. The two eagles are too large to be confused with the hawks, and the white head and tail of this species is wholly distinctive.

"The favorite food of the Bald Eagle is fish, and where this vertebrate can be procured the bird will touch little else. Of the hundreds of these Eagles which the writer has watched, none were observed ever to touch anything except fish or offal picked up from rivers or along their shores. What proportion of the fish consumed is taken from the Osprey is hard to estimate, but the number must be very great.

"What we have said in reference to the Golden Eagle

applies equally well to the bird under consideration, namely, that over the greater part of the country where the natural food, fish in the present case, is abundant it is a harmless bird and should be protected; while in sections where it is injurious to sheep or other domesticated animals it should not be allowed to become numerous." (Fisher.)

There seem to be several well authenticated instances when this eagle has attacked human beings, for one cause or another, but it is equally true that it does not often do so. Indeed, the provocation would have to be great, for the birds are usually cowards in the presence of man.

It is well known that the Bald Eagle's regular practice is to wait until the Osprey has captured a fish when the eagle attacks him and forces him to drop it, whereupon the eagle secures it for himself. While it is hard on the Osprey it is easy for the eagle.

133. (356.) *FALCO PEREGRINUS ANATUM* (Bonap.). 162.
Duck Hawk.

Synonyms: *Falco communis* var. *anatum*, *Falco peregrinus naevius*, *F. peregrinus*, *F. anatum*, *F. communis*.

Peregrine Falcon, Great-footed Hawk, Wandering Falcon.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

The Duck Hawk seems to be the least known of our smaller hawks, yet it must be pretty well distributed over the state, at least in winter. It is one of the most fearless of our birds of prey, and a true Falcon in its swiftness of wing, quickness, and dash. It is able to overtake and kill a pigeon or teal in full flight. Nothing seems able to escape by its swiftness alone. It is also persistent to the last degree, following a flock of ducks or other birds for miles, often for days, killing whenever hungry. Hunters often complain that their kills have been seized by this hawk from under their hands.

Concerning the actual records for this hawk within the state there is little to say. Mr. Dury has taken several specimens at St. Mary's reservoir; Dr. Jasper took one at Columbus; there is a specimen in the collection of Mr.

A. Hengartner, of Lorain, taken near the lake shore; and a specimen was taken in one of the State University buildings during the winter of 1902-3. Mr. W. L. Dawson reports one positively identified, at Columbus, March 5, 1902. There are reports of other birds having been seen, but if there have been any captures they have not been reported. Dr. Wheaton supposed that it might be found nesting in the northwestern part of the state, but if it does it is unknown to me.

The large size for a Falcon and the boldness and swiftness of this hawk are about all the field characteristics that I can give. It could not be taken for one of the Buteo group, nor for anything but a Falcon. It is the largest of that group inhabiting Ohio.

"The food of this hawk consists almost exclusively of birds, of which water-fowl and shore birds form the greater part. In sections of the country where its nest is surrounded by cultivated lands, the bird is bitterly complained of by the farmers on account of its inroads on the poultry." (Fisher.)

134. (357.) *FALCO COLUMBARIUS* Linn. 163.

Pigeon Hawk.

Synonyms: *Æsalon columbarius*, *Hypotriorchis columbarius*,
Falco lithifalco var. *columbarius*.

Kirtland, Ohio Geol. Surv., 1838 161, 178.

This little Falcon appears to be rare in the state, as a migrant or winter resident everywhere except in the northern tier of counties where it has been found breeding rarely. There are generally several records each winter near Oberlin. During the migrations it may be found near or even traveling a little behind the flocks of blackbirds and other small flocking birds, preying upon them. It should be found during the winter in the southern parts of the state pretty regularly, but in small numbers.

"The food of the Pigeon Hawk consists mainly of small and medium sized birds, especially the gregarious species, insects, and occasionally small mammals. Pigeons, Flickers and Grackles are about as large birds as it usually attacks,

though Dr. Dall in one instance saw it kill a Ptarmigan, and Dr. E. A. Mearns speaks of a specimen shot in the act of destroying a hen. Among insects dragon flies are favorite morsels for this Hawk, and the apparent ease with which it captures these nimble winged insects demonstrates better than anything else its remarkable power of flight. The writer has also found grasshoppers, crickets and beetles among the stomach contents." (Fisher.)

It is not easy to distinguish between this and some others of the small hawks. However, this is one of the smallest and darkest, with the habits of a Falcon, snatching its prey from the ground or in the air without stopping its flight instead of pouncing upon it and bearing it down by its weight.

135. (360.) FALCO SPARVERIUS Linn. 164.

:" American Sparrow Hawk.

Synonyms: Tinnunculus sparverius.

Sparrow Hawk, Rusty-crowned Falcon.

Kirtland, Ohio Geol. Surv., 1838, 161, 178.

This is universally conceded to be the commonest of our hawks. It is common everywhere during the summer, but is less common in the northern third of the state in winter than in summer. It frequently comes into towns and city parks at almost any time, to catch English Sparrows, and is therefore seen by many persons who know nothing about any other hawks. It is readily distinguished from all other hawks by its bright rufous back and tail, and in the field by its habit of hovering over a meadow as it scans the ground for a mouse or insect. I have seen one spend an hour looking over a ten-acre field in this way, hovering in one place for about a minute, then change its position and hover again, and finally fly to another field when unsuccessful.

"The Sparrow Hawk is almost exclusively insectivorous except when insect food is difficult to obtain. In localities where grasshoppers and crickets are abundant these hawks congregate, often in moderate sized flocks, and gorge themselves continuously. Rarely do they touch any other kind

of food until, either by the advancing season, or for other natural causes, the grasshopper crop is so lessened that they can no longer appease their hunger except by undue exertion. Then other kinds of insects and other forms of life contribute to their fare; and beetles, spiders, mice, shrews, small snakes, lizards or even small birds are required to bring up the balance." (Fisher.) It therefore seems certain that the farmer has no better friend than this little Falcon. He may rarely exact toll in the form of chicken meat, but that should no more count against the whole group of Sparrow Hawks than an occasional chicken stealing cat should count against all cats.

While this hawk nests in hollow trees in the woods, or more properly on the borders of woods preferably, it is more often seen in the open than in the woods, except when nesting. It feeds in the open then but stays near home.

136. (364.) *PANDION HALIAETUS CAROLINENSIS* (Gmel.).
165.

American Osprey.

Synonyms: *Pandion haliaetus*, *Falco haliaetus*, *Pandion carolinensis*, *Falco carolinensis*.

Fish Hawk, Osprey.

Kirtland, Ohio Geol. Surv., 1838, 161.

The Osprey is not common anywhere in the state, but it is likely to be present wherever fish are to be found near the surface of the water. It should breed at the large reservoirs and lakes, but there are no such reports from those regions. It is found all summer at the lake shore, but I am not aware that a nest has actually been found. Rev. Mr. Henninger states that it occurs in Scioto and Pike counties during the winter and during the spring and autumn migrations in some numbers, feeding along the Scioto river. It visits the Oberlin water-works reservoir pretty regularly the first or second week in May, often tarrying for several days in the vicinity because the fish are so numerous and so easy to catch.

The Osprey's food is exclusively fish, almost always cap-

tured alive, but rarely dead ones are picked up from the surface of the water if the bird is hard pressed for food. I have seen it catch fish so large that it was barely able to get out of the water with its catch. There are instances when the bird has struck so large a fish that, unable to loosen his hold, he has been drawn under the water and drowned. Large fish have been washed ashore with an Osprey still clinging to them in death, the claws set too firmly in flesh and scales to be loosened.

It has been stated that where Bald Eagles are found there the Osprey will be also. That has not proved true in the region of Sandusky where the eagles are more numerous than elsewhere in the state. Perhaps the Ospreys have learned to avoid that region.

SUBORDER STRIGES. Owls.

Family STRIGIDÆ. Barn Owls.

137. (365.) *STRIX PRATINCOLA* Bonap. 152.

American Barn Owl.

Synonyms: *Strix flammea* var. *americana*, *S. flammea*, *Aluco flammeus americanus*.

Barn Owl, Monkey-faced Owl.

Kirkpatrick, Ohio Farmer, VIII, 1859, 35.

"Rare visitor. Not over half a dozen individuals recorded." (Wheaton.) There has been a very manifest increase in the numbers of this owl since Dr. Wheaton wrote the above quotation. It is now almost common in the southern parts of the state, being even common locally. In the northern half of the state it is generally reported as rare. Numbers of specimens have been taken along the whole lake front. It is resident everywhere, and will usually be found in barns and church steeples or similar places where it spends the day, sallying forth at dusk for its daily catch of rats and mice.

The bird may be known at once by its "monkey face," lack of ear tufts, and bright reddish-brown color. It is

considerably larger than the Screech Owl, which may be reddish, but has ear tufts.

"All testimony goes to show that the Barn Owl is one of the most beneficial of rapacious birds. . . . Its food undoubtedly consists principally of several species of rodents which, from their great number and destructive habits, are a curse to the country they inhabit. . . . In the east its food consists largely of mice and rats which it destroys with as much energy as it does the gophers of the west. All the common species, including the meadow, house, and white-footed mice, as well as the common rat are eaten with equal relish" (Fisher). Mr. Charles Dury gives an account of a colony of these owls which lived in the town hall in Glendale, Ohio, in which he says, "But the strangest part of the curious habitation was the flock of domestic pigeons that were living seemingly on intimate terms with the owls, and, judging from the old pigeon nests, I presume the pigeons had actually nested and reared their young there. The floor where they lived was literally covered with the pellets which the birds had disgorged, after the manner of the owl tribe." It seems to be beyond question that one Barn Owl is worth a whole family of cats as a mouser, and that it is far less likely to steal a chicken than the average cat is.

Family BUBONIDÆ. Other Owls.

138. (366.) *ASIO WILSONIANUS* (Less.). 153.

American Long-eared Owl.

Synonyms: *Otus vulgaris* var. *wilsonianus*, *Asio americanus*,
Otus vulgaris, *O. wilsonianus*.

Long-eared Owl, Cat Owl.

Audubon, Orn. Biog., IV, 1838, 572.

One must look in the woods for this owl, where it nests and where it feeds by night and rests by day. It is not common anywhere in the state, but is pretty generally distributed. In Lorain county it has been found both singly and in companies of six individuals in winter, and its cry is sometimes heard during the summer while it is nesting. It

inhabits the stream gorges in which there is a considerable growth of evergreen trees, in winter, and may be closely approached there. While it is strictly nocturnal it can see well enough in bright sunlight to thread its way in rapid flight through the mazes of the trees. Its confidence in its protective colors and attitude often proves fatal.

This owl may be identified in the field as a medium-sized bird with conspicuous ear tufts. The only other owls with conspicuous ear tufts are either so much smaller or so much larger that one should have no difficulty in making the determination.

"The Long-eared Owl is one of our most beneficial species, destroying vast numbers of injurious rodents and seldom touching insectivorous birds. As this owl is readily destroyed, it is the one that suffers most when short-sighted legislators enact laws for the destruction of the birds of prey. It is both cruel and pernicious to molest a bird so valuable and innocent as the one under consideration." (Fisher.) Like other birds of prey, this owl will attack poultry or even small dogs when hard pressed for food. Insects may form a fair proportion of the summer diet of these birds where they are easier to obtain than rodents.

139. (367.) *ASIO ACCIPITRINUS* (Pall.). 154.
Short-eared Owl.

Synonyms: *Brachyotus palustris*, *Strix brachyotus*, *Brachyotus cassinii*, *Otus brachyotus*, *Strix accipitrinus*.

Marsh Owl, Prairie Owl.

Kirtland, Ohio Geol. Surv., 1838, 161, 179.

This owl is just as truly a bird of the open fields as the Long-eared is of the woods. It even nests on the ground, and roosts under overhanging banks in almost any ditch or considerable gorge. In Lorain county I have never seen more than two together, and they on the lake shore in winter. Several are seen each winter or early spring, but it must be regarded as uncommon if not rare. I have never seen it in summer. It appears to be common during the win-

ter in some parts of the southern counties, and likely nests in the more extensive prairies and swampy regions. It may be known by its habit of feeding during the early forenoon and late afternoon in broad day, and by its habit of feeding in the fields. While it has ear tufts they are too small to be seen unless the bird raises them in excitement.

"The food of this Owl consists largely of mice and other small mammals. A number of species of insects, birds, and reptiles also may be mentioned as occasionally contributing to its fare. Fully 75 per cent of the stomachs examined in the Department of Agriculture contained mice. . . . Of the other mammals which this Owl feeds upon may be mentioned shrews, gophers, and sometimes small rabbits." (Fisher.) The verdict is clearly for protection of this owl, even if he does sometimes kill useful animals."

140. (368.) *SYRNIUM VARIUM* (Barton). 155.
Barred Owl.

Synonyms: *Strix nebulosa*. *Syrnium nebulosum*.

Hoot Owl, American Wood Owl, Round-headed Owl.

Kirtland, Ohio Geol. Surv., 1838, 161.

This is the most common large owl, and stands next to the Screech Owl in numbers. It is strictly resident throughout the state, and as strictly arboreal. It is nocturnal, but sometimes feeds during dark days or at twilight. Its cry "*who cooks for you, who cooks for you, who!*" may be heard in almost any large woods during the early evening or early morning hours, while its blood-curdling caterwaulings are more often reserved for the small hours when the camper is sure to be asleep! In these later days some of the thrilling accounts of "encounters" with wild cats and panthers in the more settled districts of the state are traceable to the night calls of this owl. Certain it is that a sudden awakening in the wee hours with the unearthly squalls from this owl, perched just overhead, ringing in your ears, meets instant response from your hair!

"In summing up the facts relating to the food habits of this Owl it appears that, while the general statements of

certain authors, especially the earlier ones, charge the bird with destruction to poultry, game, and small birds, such destructive habits are comparatively uncommon. That it does occasionally make inroads upon poultry yards, and does more or less damage among game birds, is true; but the systematic collection and examination of a large number of stomachs show the exceptional character of such acts and reveal the fact that the larger part of the food consists of mammals. And it is to be noted that among the list are some of the most destructive rodents the farmer has to contend with. If a fair balance is to be struck, therefore, it must be considered that this Owl is on the whole beneficial, and hence should occupy a place on the list of birds to be protected." (Fisher.)

141. (370.) *SCOTIAPTEX NEBULOSA* (Forst.). 156.

Great Gray Owl.

Synonyms: *Syrnium cinereum*, *Ulula cinerea*, *S. lapponicum* var. *cinereum*, *Strix cinerea*. *Scotiaptex cinerea*.

Spectral Owl.

Kirkpatrick, Ohio Farmer, VIII, 1859, 107.

The records given by Dr. Wheaton remain the only ones for the state. They are: Mr. Kirkpatrick, Huntsburg, Geauga county; and Mr. Charles Dury, Clarke county. It must therefore be regarded as a casual visitor.

142. (372.) *NYCTALA ACADICA* (Gmel.). 157.

Saw-whet Owl.

Synonyms: *Nyctale acadica*, *Strix acadica*, *Ulula acadica*.
Acadian Owl.

Audubon, Orn. Biog., II, 1834, 537.

This little owl, the smallest of the group in Ohio, is almost wholly a winter resident in the state, breeding only rarely in the northern counties. It is probably more numerous than the reports show, for it is the most strictly nocturnal of the owls, and therefore seldom seen. Its small size is also a good protection from prying eyes. Like the Barred Owl, it has no ear tufts. It seems partial to evergreen

woods, but has been found on several occasions in an out-house of one of the lake summer resorts. The most of the reports of its occurrence fall within the colder part of the year, but it has been seen at Cincinnati in May (Dury), and it was found in May at Licking reservoir (Dawson).

"The food of this little Owl is composed almost wholly of mice, of which the wood-dwelling species seem to predominate. At times it attacks larger mammals, such as rats, half-grown red squirrels and chipmunks. . . . It rarely molests small birds, unless its favorite food—mice—for some reason, is scarce. Occasionally it feeds on scraps of raw or cooked meat which it has been observed to pick up in the vicinity of camps, and in winter, in the north, it will feed on the carcasses of comparatively large animals. . . . It also feeds to some extent on insects of various kinds. Thus it will be seen that while the diminutive size of the Saw-whet limits its powers of usefulness, its mode of life renders it a useful adjunct to the farmer, and, small though it be, yet in districts where it abounds the number of mice it annually destroys must be very large." (Fisher.)

143. (373.) MEGASCOPS ASIO (Linn.). 158.

Screech Owl.

Synonyms: *Scops asio*, *Strix nævia*.

Mottled Owl, Little Horned Owl, Red Owl.

Kirtland, Ohio Geol. Surv., 1838, 161, 179.

This is one of the most numerous and best known of our owls, and is the bird from which most persons get their idea of what an owl is like. In the more settled districts this owl seems to prefer to live in buildings other than dwellings, or in hollow shade trees. There are numerous instances of captures during the evening church service which, from all accounts, left neither the owl nor the audience in a worshipful frame of mind! The natural home of the Screech Owl is the deeper woods, where it frequently roosts and always nests in hollows in trees. It also spends the day in some thick foliated tree. On the Oberlin College campus a male is in the habit of spending the day in

an evergreen near the main walk leading from the Library to the Chapel building. His presence would never be suspected if the Blue Jays would mind their own business instead of his. This pair rears its brood in the loft of either French Hall or the Chapel.*

This little owl may be known by its conspicuous ear tufts and reddish or grayish mottled plumage. Its quavering call is often heard during the spring months.

"Their food consists of a great variety of animal life, including mammals, birds, reptiles, batrachians, fish, crustaceans, and insects. . . . Their economic relations, therefore, are of the greatest importance, particularly on account of the abundance of the species in many of the farming districts, and whoever destroys them through ignorance or prejudice should be severely condemned." (Fisher.)

144. (375.) BUBO VIRGINIANUS (Gmel.). 159.

Great Horned Owl.

Synonyms: *Strix virginianus*.

Hoot Owl, Cat Owl, Hooter.

Wilson, Am. Orn., 1812, 52.

This is the largest of our "horned" owls, and is generally reported as fairly common but disappearing near the large cities. It is rare in Lorain county, but three individuals being known in the western half of the county. Its large size should make it a conspicuous bird. I have found it only when crows and hawks have routed it from its retreat. It inhabits the larger, heavier woods, and is hardly more than semi-nocturnal, sometimes feeding by day. It nests indifferently in open nests or hollow trees.

It may be known at a glance by its white throat patch, large ear tufts, and powerful build.

"The food of this species is of great variety; birds and mammals as well as reptiles, fish, crustaceans, and insects contribute to its fare. Among the birds most often taken may be mentioned all kinds of poultry (including half-

*Since the above was written the chapel has burned. I am glad to report that the owl escaped unscorched.

grown turkeys), grouse, quail, doves, and wild ducks. Even hawks, crows, and other owls do not escape the voracity of this tiger among birds, and the large hawks are among those attacked and eaten.

"Of all the birds of prey, with the exception possibly of the Goshawk and Cooper Hawk, the Great Horned Owl is the most destructive to poultry. All kinds of poultry seem to be taken, though when Guinea fowls and turkeys are obtainable it shows a preference for these." (Fisher.) While this bird does a great deal of good in ridding the country of injurious animals, its natural taste for poultry sounds its death knell. We must feel a sort of compassion for him in his unequal struggle for life. He sees no reason for changing his manner of life and we cannot overlook his failings.

145. (376.) *NYCTEA NYCTEA* (Linn.). 160.

Snowy Owl.

Synonyms: *Nyctale scandica*, *Nyctea scandiaca*, *N. nivea*, *N. scandiaca* var. *arctica*, *Surnia nyctea*.

White Owl.

Wilson, Am. Orn. IV, 1812, 53.

The Snowy Owl visits the state only in winter and even then in small numbers unless there be some special provocation in the matter of failure of food supply farther north. It occasionally wanders completely across the state, but is clearly more numerous along the lake shore than in the interior. It also seems to be more numerous in the western third than farther east. We could hardly expect to find it except when the ground is covered, and the weather cold.

This bird is not pure white, but so near that color as to appear white. No one would confuse it with any other species of birds.

The favorite food of this large, smooth-headed owl seems to be mice and other rodents and fish. Its numbers in Ohio are too small to make it of any appreciable benefit, but it must be regarded as more beneficial than injurious. It probably does eat birds, and may even catch poultry on a pinch, but the numbers captured are very small.

146. (377a.) *SURNIA ULULA CAPAROCH* (Müll.). 161.
American Hawk Owl.

Synonyms: *Surnia ulula* var. *hudsonia* *S. funerea*, *S. ulula*,
Strix ulula, *S. hudsonia*, *S. caparoch*.

Hawk Owl, Day Owl.

Kirkpatrick, Ohio Farmer, VIII, 1859, 67.

The above reference and the remark that "Mr. Langdon thinks that he has seen this species at St. Mary's reservoir," are all that Dr. Wheaton knew of this species as an Ohio bird. There is a specimen in Mr. R. E. Jump's collection, captured near Oberlin some twenty years ago. Messrs. C. H. Morris and E. J. Arrick report one in Morgan county during the winter 1901-02, which was not captured. It therefore appears that the only specimen which can be examined is the Jump specimen.

This owl is so named because in appearance and habits of feeding it resembles a hawk more closely than an owl. In habits it is almost wholly diurnal, feeding and flying from place to place in broad day.

While in the state its food consists of small mammals and birds. It is probably somewhat injurious, but its numbers are so small as to count for nothing economically.

ORDER COCCYGES. Cuckoos and Kingfishers.

SUBORDER CUCULI. Cuckoos.

Family CUCULIDÆ. Cuckoos.

147. (387.) *COCCYZUS AMERICANUS* (Linn.). 149.
Yellow-billed Cuckoo.

Synonyms: *Cuculus americanus*.

Rain Cuckoo, Rain Crow, Rain Pigeon, Wood Pigeon, Cow-cow, Indian-hen.

Kirtland, Ohio Geol. Surv., 1838, 162.

This is the commoner of the two cuckoos in Ohio, and seems to be pretty uniformly distributed over the state during the summer. There is no evidence of an appreciable change in numbers since Dr. Wheaton's catalogue was published.

It is well known that the cuckoos are fond of the "hairy" caterpillars, and destroy great numbers of them. I have seen one bird disposed of a moderate sized colony of tent caterpillars at one sitting, in the nesting season. Both cuckoos deserve protection and good treatment for their services in ridding us of many insects which most other birds will not touch.

This is the darker of the two species, and in flight the wings show the rufous of the inner vanes of the feathers. The call is on a lower key, is given slower and is not phrased. It is only after some experience with the cuckoos that one can hope to be certain which species he has afield.

The migration records are far from satisfactory. They make it appear that the first arrive in the state shortly after the first of May and the last tarry until the third week in September. I have to say, however, that I have repeatedly found nests with eggs almost ready to hatch the first week in May, thus indicating an early April arrival.

148. (388.) *COCYZUS ERYTHROPHthalmus* (Wils.).
150.

Black-billed Cuckoo.

Synonyms: *Cuculus erythrophthalmus*.

Rain Crow, Rain Dove, Chow-chow, Cow-cow.

Audubon, Orn. Biog., I, 1831, 170.

Dr. Wheaton's statement that this cuckoo is a very common summer resident throughout the state is no longer applicable. The reports from observers are nearly uniform in pronouncing it decidedly less common than the preceding species. In habits it is practically the same as the Yellow-billed. The cry is phrased instead of being uttered in a uniform monotone.

SUBORDER ALCYONES. Kingfishers.

Family ALCEDINIDÆ. Kingfishers.

149. (390.) CERLYLE ALCYON (Linn.). 148.
Belted Kingfisher.

Synonyms: Alcedo alcyon.
Kingfisher, Fisher.

Wilson, Am. Orn., III, 1811, 59.

The Kingfisher is a resident in favorable places, where open water may be found the winter through, and where fish are plentiful; but it is not known as a winter bird from most localities, simply because open water is not found in the coldest weather. In Lorain county there is no open water, regularly, even along the lake shore, where fish can be found;* but at Norwalk a pool which is fed by warm water from a manufacturing plant furnishes at least one Kingfisher with winter rations. In the southern part of the state it is more commonly found all winter and summer. Migrants reach Oberlin about the middle of March.

The Kingfisher feeds entirely upon fish, but cannot be considered in any degree injurious to the fishing industry.

*Since the above was written a pool of open water has been discovered about two miles north of Elyria where a Kingfisher spends the winter.

ORDER PICI. Woodpeckers, Sapsuckers and Flickers.

Family PICIDÆ. Woodpeckers.

150. (393.) DRYOBATES VILLOSUM (Linn.). 140.
Hairy Woodpecker.

Synonyms: Picus villosus, P. rubricapillus.
"Sapsucker."

Kirtland, Ohio Geol. Surv., 1838, 162.

This is a common resident throughout the state, but apparently is less common in summer than in winter. Its secretive habits during the nesting season probably give a false impression. This and the next species frequent the

orchards and shade trees during the winter and spring, sometimes nesting in old apple trees. Their search after insects within the bark of trees has earned for them the mistaken title of Sapsucker, and with the title a measure of persecution. It is doubtful whether either of these birds have ever done as much damage as good to the tree from which they have taken injurious insects. Wood-boring beetles, both adults and larvæ, caterpillars, mostly tree-burrowing, and wood-boring ants comprise the chief summer food. It is therefore clear that this woodpecker is one of our best preservers of the forests. In winter they may eat nuts, frozen fruit, and weed seeds when insects are hard to find. They also eat the inner bark of some trees.

There seems to be no direct evidence that this and the next species migrate at all.

151. (394c.) *DRYOBATES PUBESCENS MEDIANUS* (Swains.).
141.

Downy Woodpecker.

Synonyms: *Picus pubescens*, *P. medianus*, *Dryobates pubescens*.

"Sapsucker," Little Sapsucker, Small Sapsucker.

Kirtland, Ohio Geol. Surv., 1838, 162, 179.

This is the more familiar and better known of our two small winter woodpeckers. A little encouragement in the way of broken nut meats or suet tied or nailed to some tree or board placed for that purpose, will make him a regular winter visitor even to the window sill. In summer he is likely to choose a useless apple tree for his nest, if not startled away.

This and the preceding species troop through the woods, in winter, with the Chickadees, Tufted Tits, Nuthatches, and Goldfinches, and often others, making an otherwise dreary waste of timber full of life and interest.

In habits this little woodpecker resembles the Hairy closely, eating the same kind of food. It may be known from the Hairy by its smaller size and weaker bill, and higher pitched voice.

152. (400.) *PICOIDES ARCTICUS* (Swains.). 142.

Arctic Three-toed Woodpecker.

Synonyms: *Picus* (*Apertus*) *arcticus*.

Black-backed Woodpecker, Black-backed Three-toed Woodpecker, Ladder-backed Woodpecker, Banded-backed Three-toed Woodpecker.

Wheaton, Ohio Agri. Report, 1860, 379, hypothetical.

Baird, Brewer, Ridgway, II, 1874, 531.

The specimen reported by Dr. Brewer in the second citation above, was taken at Akron, Summit county. Oberlin College has since come into possession of a specimen collected and mounted by Mr. John C. Catlin at Ravenna, Portage county. It is not unlikely that Mr. Catlin secured his specimen first, but this is the first mention of it in print.

Prof. J. S. Hine, of Columbus, gives it as occasional in Franklin county.

It would occur only in severe winters.

153. (402.) *SPHYRAPICUS VARIUS* (Linn.). 143.

Yellow-bellied Sapsucker.

Synonyms: *Picus varius*.

Yellow-bellied Woodpecker, Sapsucker, Common Sapsucker.

Wilson, Am. Orn., I, 1808, 147.

This is the true "Sapsucker," and should not be confused with our familiar winter woodpeckers. It feeds upon the sap of the maple and pine trees in spring, and often causes some damage to the trees, sometimes girdling the tree with one or more rows of holes. It is undoubtedly true that the insects which swarm about the exuding sap are also eaten, so the object which the woodpecker has in view in tapping the tree may be twofold. During the rest of the year the birds eat insects, some mast, the inner bark of trees, and such vegetable food as can be found.

It is common as a migrant across the state, both spring and autumn, but nests in small numbers in the northern part of the state. It winters in small numbers in the southwest corner, reaching the lake shore in the northward migration during the middle of March. It crosses the state

again during the first half of October. A few individuals remain in almost any locality all winter.

154. (405a.) *CEOPHLEUS PILEATUS ABIETICOLA* Bangs.
144.

Northern Pileated Woodpecker.

Synonyms: *Hylotomus pileatus*, *Picus pileatus*, *Ceophlœus pileatus*.

Pileated Woodpecker, Logcock, Woodcock, Big Black Woodpecker, Black Woodpecker, King of the Woods, Cock of the Woods.

Kirtland, Ohio Geol. Surv., 1838, 162.

The decrease in the numbers of this species heralded by Dr. Wheaton in 1882, has gone on steadily, but less rapidly than during his long term of study. From all reports it is now almost gone from the northwestern parts of the state, but can be found in the eastern and middle-southern parts where some heavy timber is still allowed to stand. The cutting down of a large tract of swampy woods in Ashtabula county has driven some of the birds remaining there to the woods surrounding Jefferson, where Mr. Robert J. Sim enjoyed the rare opportunity of watching a pair at their household affairs during last spring. The writer saw the tree, in September of the same year, and listened to the weird laugh of the birds. If the woods are doomed the Pileated Woodpecker's days are numbered. We cannot but mourn the passing of this majestic "King of the Woods."

The food consists principally of the larvæ of wood-boring beetles, ants, and wild fruits. It is, therefore, one of our best forest preservers.

155. (406.) *MELANERPES ERYTHROCEPHALUS* (Linn.) 146.
Red-headed Woodpecker.

Synonyms: *Picus erythrocephalus*.

Red-head, Tricolor.

Kirtland, Ohio Geol. Surv., 1838, 162.

The Red-head is one of our commonest summer birds. It may fairly be called abundant after the young have left the

nest, and until the first frosts give warning of the coming winter. It reaches southern Ohio about the 25th of April, and the northern counties within three days afterward. Frequently a few individuals remain all winter even at the lake shore, but the majority have left the northern regions before the last of September.

The Red-head is not quite a true woodpecker, since he does not search the bark of trees for insects and worms as much as he looks for them on posts and such surfaces, but he has developed the flycatcher habit of darting out for flying insects, catching them as adroitly as any Kingbird. The late General J. D. Cox told with evident relish how as a boy he took advantage of this flycatching habit to catch the bird. By tossing a small stone up past the bird alert upon the top of some broken topped dead tree, as the stone fell downward the bird would invariably dart out to catch it, but was stunned and fluttered to the ground only to be pounced upon and carried off in triumph by the young general!

"The Red-head makes the best showing in the kinds of insects eaten. It consumes fewer ants and more beetles than any of the other species, in this respect standing at the head, and it has a pronounced taste for beetles of very large size. Unfortunately, however, its fondness for predaceous beetles must be reckoned against it. It also leads in the consumption of grasshoppers; these and beetles together forming 36 per cent. of its whole food." (Beal.) It also eats a little corn, a good deal of wild and cultivated fruit, and beech-nuts. It does not injure trees by pecking them. The nest is dug out of almost any woody substance, preferably a tree, but frequently a post will do as well.

156. (409.) *CENTURUS CAROLINUS* (Linn.). 145.

Red-bellied Woodpecker.

Synonyms: *Melanerpes carolinus*, *Picus carolinus*.

Zebra Bird, Guinea Woodpecker, Carolina Woodpecker, Checkered Woodpecker, Zebra Woodpecker, Orange Woodpecker or Sapsucker.

Wilson, *Am. Orn.*, I, 1808, 113.

The Red-bellied Woodpecker is fairly common in the

southern part of the state, but less numerous in the northern part. It is a resident everywhere, nesting in the deeper woods.

In addition to its usual diet of insects and worms it is a lover of ripe apples, and in winter finds acorns and beechnuts good forage. It has been detected in the act of storing away acorns and nuts for winter consumption.

157. (412a.) *COLAPTES AURATUS LUTEUS* Bangs. 147.
Northern Flicker.

Synonyms: *Colaptes auratus*, *Picus auratus* *Cuculus auratus*.
Golden-winged Woodpecker, Flicker, High-holder. For the remainder of the 125 English synonyms see "The Wilson Bulletin," No. 31, for sale by the author at 25 cents a copy.
Kirtland, Ohio Geol. Surv., 1838, 162.

The Flicker is probably strictly migratory in its habits, in spite of the fact that it is resident throughout the state—in small numbers in the north, common in the south. It is abundant as a migrant, but hardly more than common during the nesting season. In winter it will eat anything that can be found. In summer it seems to crave ants, of which it consumes quantities. During harvest days it becomes lazy and then feeds on the ground like a Meadowlark, catching the young grasshoppers and crickets and fattening upon them. It must be classed among the distinctly useful birds, both as a destroyer of insects and as an alarm clock if you have been so unwise as to cover any part of your roof with tin! 3:30 in spring, 4:00 in summer and 4:30 in autumn are the hours which he loudly heralds for the beginning of day. You can't drive him away.

The migrating host of Flickers reaches northern Ohio during the third week in March. Its numbers are considerable up to the middle of October, or even the first of November.

ORDER MACROCHIRES. Goatsuckers, Swifts, Humming-birds.

SUBORDER CAPRIMULGI. Goatsuckers.

Family CAPRIMULGIDÆ. Nighthawk and Whippoorwill.

158. (417.) *ANTROSTOMUS VOCIFERUS* (Wils.). 138.
Whip-poor-will.

Synonyms: *Caprimulgus vociferus*.
Night-Jar.

Kirtland, Ohio Geol. Surv., 1838, 162, 180.

The Whip-poor-will is decidedly local in its distribution, being common at one place and unknown at another not far away, with no apparent reason. It is strictly nocturnal in habits, and is therefore more often heard than seen. Even when flushed in daylight it flies but a few rods and settles down again, trusting to its protective coloration for concealment. So perfectly does its plumage and posture simulate a part of a log, or a knot on a log, that it is perfectly hidden from all but practiced and discriminating eyes. Being strictly insectivorous it is strictly migratory in habits, reaching southern Ohio during the third week in April and the northern counties shortly after the first of May. It has left the state by September 22.

In northern Ohio one must look for the Whip-poor-will in the wilder and rougher parts of the region. River gorges and rocky bluffs may harbor numbers of pairs.

159. (420.) *CHORDEILES VIRGINIANUS* (Gmel.). 139.
Nighthawk.

Synonyms: *Chordeiles popetue*, *Caprimulgus virginianus*, *C. popetue* var. *popetue*.

Bull Bat, Goatsucker, Night Jar, Mosquito-hawk, Pisk.
Kirtland, Ohio Geol. Surv., 1838, 162.

Contrary to its name, the Nighthawk is not strictly nocturnal, but is rather a bird of the twilight and dark days, but it is frequently seen at broad day, particularly during the season of southward migration. It is more numerous dur-

ing twilight, when it may be seen leisurely flitting about in crazy fashion gathering its harvest of flying insects, with an occasional quick dart here or there after some larger and quicker prey. It is strictly migratory, reaching our southern border about the first of May, and the lake shore a week later; departing southward again about the middle of September. It is thus a little later in appearing and a little earlier in leaving than Whip-poor-will.

In northern Ohio, at least, it seems to nest preferably on the tops of our taller city buildings. I have yet to learn of a nest that has been found in the woods within thirty miles of Cleveland.

The Whip-poor-will and Nighthawk take up the destruction of insects where the swallows and flycatchers leave it. We could wish there were more of all kinds of insect eaters, particularly those which feed at night.

SUBORDER CYPSELI. Swifts.

Family MICROPODIDÆ. Swifts.

160. (423.) CHÆTURA PELAGICA (Linn.). 137.

Chimney Swift.

Synonyms: *Hirundo pelasgia*, *H. pelagica*, *Cypselus pelasgius*, *Chætura pelasgica*.

Chimney Swallow, Common Swift, Swift.

Wilson, *Am. Orn.*, V, 1812, 48.

This familiar bird is pronounced abundant over the entire state. It nests in the smaller chimneys, and roosts in communities in the larger chimneys. I find no records of nesting in hollow trees. Dr. Wheaton speaks of the probability that a few pairs nested in an old hollow tree three miles east of Columbus, prior to 1882.

The Swifts reach Ohio about the middle of April, and seem to distribute themselves pretty generally at once. Migration dates for the southern and northern counties do not differ materially. They do not leave the vicinity of Oberlin until mid-October, sometimes lingering well into the third week.

Presumably the Swifts must rest at some time, but when seems a mystery. We see them only on the wing, never perched, unless it be in a chimney near or on the nest. Of course their food consists entirely of flying insects captured while flying. No one ever questioned the usefulness of this strong-winged bird.

SUBORDER TROCHILI. Hummingbirds.

Family TROCHILIDÆ. Hummingbirds.

161. (428.) TROCHILUS COLUBRIS Linn. 136.

Ruby-throated Hummingbird.

Kirtland, Ohio Geol. Surv., 1838, 164.

This is the only Hummingbird which ever visits Ohio. It is common all summer over the entire state, nesting either near dwellings or in the woods as fancy may dictate. The head contains no poison gland, so the thrust of the beak is not poisonous unless the bird has just been feeding upon some plant whose blossom is poisonous.

The Hummingbird is not one of the strongest winged birds, but frequently perches for rest. It has brought to perfection the art of hovering and darting as well as forward flight, but cannot soar. It is a great fighter in its way, easily putting to rout Catbirds, Robins and Blue Jays; not by striking with either wings or beak (its feet are too small and weak to be used in that way), but by hovering and dancing close to the bird which it chooses to put to flight. The buzzing, jiggling movement seems to confuse its adversary.

The Hummer reaches our southern border about the first of May, but is a week later at the lake shore. It leaves the state about the middle of September, often tarrying a little longer at the south.

Probably no bird could long live upon a diet of honey alone. It must certainly be true that the Hummingbird eats honey, because its tongue is made that way, but it is just as true that it eats insects which it finds in the blossoms with the honey. It is therefore a useful bird as well as a pleasing feature of our flower gardens.

ORDER. PASSERES. Perching Birds.

SUBORDER CLAMATORES. Songless Perching Birds.

Family TYRANNIDÆ. Tyrant Flycatchers.

The birds which belong to this family are preëminently flycatchers, but while they feed so largely upon flying insects, catching them in mid-air by a sally from some position where they have been waiting, they also eat wild fruits in their season to some extent. Sometimes they descend to the ground to pick up insects seen there. The only member of the family about which complaints have been made is the Kingbird. He is fond of honey bees, and will sometimes nearly destroy a hive if not interrupted in his feast. As a group the flycatchers are among our most useful insect destroyers, supplementing the work of the swallows and Nighthawk, Whip-poor-will, and Chimney Swift.

162. (444.) TYRANNUS TYRANNUS (Linn.). 127.
Kingbird.

Synonyms: *Tyrannus carolinensis*, *T. intrepidus*, *Muscicapa tyrannus*, *Lanius tyrannus*.

Bee Martin, Bee Bird, Tyrant Flycatcher, Tyrant.

Kirtland, Ohio Geol. Surv., 1838, 163.

The Kingbird is well known to all. It is common during the summer in all parts of the state. While it may be harmful in some individual cases to bee raisers, it is a decidedly useful bird in general.

The Kingbird reaches the Ohio river about April 20, and Lake Erie five days later. It remains only until the first week in September.

163. (452.) MYIARCHUS CRINITUS (Linn.). 128.
Crested Flycatcher.

Synonyms: *Muscicapa crinita*, *Tyrannus crinitus*.

Great Crested Flycatcher.

Kirtland, Ohio Geol. Surv., 1838, 163.

This bird is almost as well known as the Kingbird, from which it may be easily distinguished by the reddish instead

of white-tipped tail. It has taken a notion to the orchards, frequently nesting in the hollow apple trees, in spite of the English Sparrow.

Its arrival follows that of Kingbird within five days, both in the south and north. It generally lingers longer in autumn, not infrequently tarrying until mid-October at Oberlin.

164. (456.) *SAYORNIS PHŒBE* (Lath.). 129.

Phœbe.

Synonyms: *Sayornis fuscus*, *Muscicapa fuscus*, *Tyrannus fuscus*.

Pewee, Pewit, Bridge Pewee, Water Pewee, Pewit Flycatcher, Phœbe Bird, Barn Pewee, House Pewee.

Kirtland, Ohio Geol. Surv., 1838, 163.

The Phœbe is almost a household bird in many parts of the state, nesting in barns and out-buildings. It also selects bridges, but still clings to its ancient nesting places when possible. Almost any rocky bluff furnishes a home for one or more pairs of Phœbes, whether a river gorge, a deserted quarry, or a natural rock face.

While a true flycatcher it is one of the early spring birds, not infrequently announcing its arrival before the 20th of March at the lake shore. It rarely departs for the south before the leaves have fallen from the trees, which is late October.

During the cold, snowy days of late March I have found Phœbe in the deep woods gleaning from the blossoms of the witch-hazel, or apparently eating the buds from a linden tree.

165. (459.) *NUTTALORNIS BOREALIS* (Swains.). 130.

Olive-sided Flycatcher.

Synonyms: *Sayornis borealis*, *Tyrannus borealis*.

Wheaton, Ohio Agri. Report, 1860, 379, 480.

I find no records for this flycatcher east of Clarke county. While Dr. Wheaton throws some doubt upon the admissibility of the records upon which he gave the species a place in his catalogue, except Dr. Langdon's statement for 1877,

there can be no reasonable question that it is a rare migrant in the western third of the state.

166. (461.) *CONTOPUS VIRENS* (Linn.). 131.

Wood Pewee.

Synonyms: *Muscicapa virens*, *Tyrannus virens*.

Pewee, Pewee Flycatcher.

Kirtland, Ohio Geol. Surv., 1838, 163.

Wood Pewee is more than common. In northern Ohio it is easily the most numerous of any of our flycatchers, because found everywhere where there are trees, except in the deep woods, and where found it is too numerous to escape the notice of the most inattentive. Its plaintive call must be familiar to every one. It is probably less numerous in the more hilly south-eastern parts of the state.

Wood Pewee is among the later arrivals from the south, rarely appearing in the southern counties before May 5th, and in the north not seldom as late as the 10th. It remains with us in Lorain county until the middle of September, but tarries until October along our southern border.

167. (463.) *EMPIDONAX FLAVIVENTRIS* Baird. 132.

Yellow-bellied Flycatcher.

Synonyms: *Tyrannula flaviventris*.

Kirkpatrick, Ohio Farmer, IX, 1860, 139.

Dr. Wheaton speaks of this species as "A common spring and fall migrant," apparently meaning over the entire state. I have never found it in Lorain county, although it has been taken there. It is not well known if a common migrant. Probably it has greatly decreased in numbers since Dr. Wheaton laid down his work. I find no records of its breeding within the state.

Dr. Wheaton states that this flycatcher is different in habits from the other small flycatchers, in that it frequents fence-rows and is timid, darting into a thicket and remaining hidden when one approaches. This may account for its apparent scarcity.

168. (465.) *EMPIDONAX VIRESCENS* (Vieill.). 133.
Green-crested Flycatcher.

Synonyms: *Empidonax acadicus*, *Tyrannus acadicus*, *Platyrhynchus virescens*.

Acadian Flycatcher, Small Green-crested Flycatcher.

Kirtland, Ohio Geol. Surv., 1838, 163.

Apparently more pairs of this woods haunting flycatcher nest in the northern half of the state than in the southern half. It is fairly common everywhere, but may almost be called abundant in the heavier woods in the north. Its small size and weak voice cause it to be overlooked by many who should know it.

In its northward migration it reaches the lake shore about the first of May, and does not return south before the second week in September.

169. (466.) *EMPIDONAX TRAILLII* (Aud.). 134.
Traill Flycatcher.

Synonyms: *Empidonax pusillus trillii*, *Tyrannus trillii*, *Muscicapa trillii*.

Little Flycatcher.

Read, Fam. Visitor, III, 1853, 359.

This is another little known species, probably rather because it is so difficult to distinguish between the small flycatchers unless one knows the song, than because the bird is rare. As a migrant it seems to be fairly common in most counties, but only a few remain to breed in the southern tier of counties. I found it breeding in considerable numbers at Licking reservoir and at Lewiston reservoir. It prefers a willow or alder fringed lake or marsh for its summer home. A short distance from such places it may not be found at all.

This is one of the last of the migratory birds to appear; sometimes not reaching northern Ohio before the middle of May, rarely before the 10th day. It is gone again by the first of September.

170. (467.) *EMPIDONAX MINIMUS* Baird. 135.

Least Flycatcher.

Synonyms: *Tyrannus acadicus*, *Tyrannula minima*.

Chebec, Sewick.

Read, *Family Visitor*, III, 1853, 359.

While this is common as a migrant throughout the state it appears to be rare as a summer resident, especially in the south. I have yet to find a pair breeding in Lorain county. It is, however, given as breeding in Erie county, and as possibly breeding in Scioto county by Rev. W. F. Henninger. It seems likely that it is local in its summer distribution. In August we found it along the Ohio river from Marietta to Ironton.

The Least Flycatcher reaches Lorain county by the 25th of April and departs about the first of September.

SUBORDER OSCINES. Song Birds.

Family ALAUDIDÆ. Larks.

The true larks are found in flocks of from a few to several hundred individuals except during the breeding season. Their food consists of weed seeds and such grains as may be scattered in the fields or by the roadside, and the eggs and larvæ of insects. Probably adult insects are also eaten to some extent. They are useful birds.

171. (474.) *OTOCORIS ALPESTRIS* (Linn.). 126.

Horned Lark.

Synonyms: *Eremophila alpestris*, *E. cornuta*, *Alauda alpestris*.

Shore Lark.

Kirtland, *Ohio Geol. Surv.*, 1838, 164, 183.

It is unfortunate that so few persons are able to distinguish certainly between our three forms of *Otocoris*. The evidence seems to be pretty clear that there has been a shifting about of *alpestris* and an invasion of *praticola* since Dr. Wheaton wrote in 1882. He was familiar with the winter bird but knew nothing of the summer form, which he would have known had it been as common as it is now.

"Abundant winter resident" is the term he applies to *alpestris*, the form known to him. After an experience of twelve years in Lorain county I would not consider it more than common. In 1882 it apparently ranged completely across the state, but now there are no extreme southern records. This, again, may be due to unfamiliarity with the birds. At any rate it is more common north than south. I have seldom seen true Horned Larks before the first considerable cold wave which brings snow. This may be late in November or not until the second week in January. Most of the Horned Larks have gone north by the middle of March, but individuals sometimes tarry until early May.

During the winter the Horned Lark is largely a seed eater, and destroys quantities of noxious weeds in embryo. During the period of snow covered landscape he searches out the freshly spread manure, or goes into the pastures where fodder has been scattered, picking up what the cattle have left or uncovered. Flocks of several hundred are not uncommon at such times.

172. (474b.) *OTOCORIS ALPESTRIS PRATICOLA* Hensh. —
Prairie Horned Lark.

Dwight, Auk, VII, 1890, 145.

This is the first specific reference. In a general way Henshaw covered Ohio in his review in 1884, but made no specific reference to Ohio. This form was not elaborated until two years after Dr. Wheaton had seen his catalogue out of the press, but since he makes no mention of the breeding of the Horned Lark it seems likely that he did not know this form. It is very probable that it invaded the state just after Dr. Wheaton laid down his work.

O. a. praticola is now the common resident form nearly throughout the state. It is naturally more numerous in the more level northern and western parts than in the rougher south-eastern. Naturally it is confused with *alpestris* by many of the Ohio men, particularly those who are familiar with the earlier classification which Dr. Wheaton used.

In general habits this form agrees with *alpestris*. During

the summer, particularly the breeding season, the regular diet of weed seeds is supplemented with insect larvæ.

Since these birds may usually be rather closely approached during the winter when they associate together, and always head into the wind; they may be readily distinguished by the yellow line above the eye in the true Horned Lark, and by the white line, with no trace of yellow, in Prairie Horned Lark. Both have yellow or yellowish throats, Horned Lark the brighter and clearer. The form *hoysi* is as large as *alpestris*, but is lighter than *praticola*, and with no yellow over the eye.

173. (474k.) *OTOCORIS ALPESTRIS HOYSI* Bishop. —.
Hoyt Horned Lark.

Synonyms: *Otocoris alpestris leucolema*.

Oberholser, A Review of the Larks of the Genus *Otocoris*, Proceedings of the U. S. National Museum, XXIV, No. 1271, 812.

The specimen above referred to, captured at Wooster, one in the Oberlin College collection, and at least three in the collection of the Ohio State University, are all of which I have any record. A critical examination of local collections may reveal others. The recent elaboration of this subspecies makes it impossible to say what its status in our state is. From the small amount of evidence I would infer that it is a winter visitor with the Horned Lark, ranging into the state from the north-west.

Family CORVIDÆ. Crows, Jays, Magpies, etc.

The food habits of the three representatives of this family which occur in Ohio are given under the species.

174. (477.) *CYANOCITTA CRISTATA* (Linn.). 125
Blue Jay.

Synonyms: *Cyanurus cristatus*, *Cyanura cristata*, *Corvus cristatus*, *Garrulus cristatus*.

Jay Bird.

Kirtland, Ohio Geol. Surv., 1838, 162.

Blue Jay is a familiar and common resident throughout the state except in the south-eastern portion. He is usually

more in evidence during the winter than during the summer, no doubt because he finds food more plentiful and more easily obtained in towns and cities. During the winter the jay is a great scavenger, visiting the kitchen waste barrel regularly. He will eat almost anything that can be digested, and sometimes other things as well. Corn and nuts furnish a good share of his winter food, where they are plentiful. His friends keep still about what he eats during the summer. There is no doubt that many nests despoiled of eggs or even young must be laid to his mischievous propensities. One might be allowed to judge of his character by the manner in which his neighbors receive him. The appearance of a jay in any neighborhood is the signal for all the birds to band together to drive him away. Prof. F. E. L. Beal's examination of 292 stomachs failed to sustain the almost universal testimony of the robbing proclivities of this bird. There was some evidence of it but too little upon which to base a sweeping condemnation. On the other hand, the Blue Jay certainly does destroy large numbers of injurious insects.

While it is probably true that the Blue Jay is migratory to some extent, the northernmost birds receding south a greater or less distance to spend the winter, and the others also crowding south to give place to them, it is not an appreciable movement in Ohio.

175. (486a.) *CORVUS CORAX PRINCIPALIS* Ridgw. 123.
Northern Raven.

Synonyms: *Corvus corax*, *C. corax* var. *carnivorous*, *C. carnivorus*.

Raven, American Raven.

Wilson, *Am. Orn.*, IX, 1825, 136.

The records seem to indicate that in Wilson's time the Raven was so common along the lake shore, particularly easterly, as to entirely supplant the Crow. It gradually decreased in numbers, until none were known except in the extreme northwest. In 1882 Dr. Wheaton regarded it as a "Rare winter visitor." Mr. Thos. Mikesell, of Wauseon,

is the only person who reports its occurrence at the present time. Other residents of Fulton county corroborate Mr. Mikesell's statement. Apparently it has been in the habit of nesting in that corner of the state and in the adjoining parts of Indiana. Doubtless the next decade will witness its complete extinction from the state.

176. (488.). *CORVUS AMERICANUS* Aud. 124.
American Crow.

Synonyms: *Corvus frugivorus*, *C. corone*.

Crow, Common Crow.

Kirtland, Ohio Geol. Surv., 1838, 162.

Our common Crow is resident in some numbers in the southern portion of the state, and may be found in small numbers in favorable places even to the lake shore. Cold, snowy winters are likely to drive most if not all individuals south at least to the center of the state. The northward movement of the Crow host reaches Lorain county early in March, but it is almost wholly dependent upon weather conditions. Not infrequently small companies of these birds may be seen moving north during the last week of February. Considerable numbers remain well into December in all but exceptionally cold winters which begin early.

It is well known that the Crow is a social bird to an unusual degree, except when nesting. Crow "Roosts" are readily located by noting the converging lines of flight during the afternoon in spring and fall, and in winter in the southern counties.

It would be superfluous to discuss the food habits of this interesting bird here. The reader can obtain an exhaustive paper upon the Crow by writing to the Secretary of Agriculture, Washington, D. C. The evidence which will be found there is slightly favorable to the Crow. But it must be admitted that during planting time he is a mischievous bird, and then may deserve a warm reception. But that he does eat many insects which destroy quantities of grain must also be freely admitted.

Family ICTERIDÆ. Blackbirds, Orioles, Meadowlarks, etc.

Most members of this family are among the best known of our birds, because they either live about dwellings or in our parks, or because they are conspicuous in either color or voice. Their food habits are discussed in detail under each species.

177. (494.) *DOLICHONYX ORYZIVORUS* (Linn.). 114.
Bobolink.

Synonyms: *Icterus agripennis*, *Fringula oryzivorus*.

Reedbird, Ricebird, White-winged Blackbird, Skunk Blackbird, Bob Lincoln, Butterbird, Ortolan, Meadow-wink, Maybird.

Nuttall, Manual, I, 1832, 185.

In his full wedding dress the Bobolink is a well-known bird; but in his traveling suit of drab and yellow he is to most persons a common sparrow. I was somewhat surprised to learn that while the Bobolink is one of our most familiar meadow inhabitants in northern Ohio, it is not found at all during the summer in the southern part, only passing through as a migrant twice a year. I found it breeding sparingly at both the Licking and Lewiston reservoirs. It is reported as common all summer as far south as Delaware, but apparently at the Licking reservoir it is near its southern breeding limit.

Being a meadow haunting bird, its appearance in the state must have followed the disappearance of the forests, except in the more open north-western counties. Dr. Wheaton places its first appearance in Geauga county in 1857.

Bobolink reaches Lorain county during the last week of April. The males change their garb during July and early August, after which the species may be found in flocks of varying size, making ready for their journey to the Florida rice fields. They are gone by the middle of September. In the southern part of the state they remain but about a week after their first appearance in spring, and return again during the second week in September, to remain but a few days.

With us the Bobolink is both interesting and useful. His irresistible burst of song is one of our treasures, and his destruction of insects and weed seeds makes him an aid to the farmer. But in the south he has found the rice fields a never failing source of food, and often pays the penalty of thieving with his life. The year through he is more useful than harmful.

178. (495.) *MOLOTHRUS ATER* (Bodd.). 115.

Cowbird.

Synonyms: *Icterus pecoris*, *Molothrus pecoris*, *Fringilla pecoris*. Cowbird, Cow Blackbird, Cow Troupial, Cow Bunting, Common Cowbird, Chuckold, Blackbird, Shinyeye, Lazy Bird, Clodhopper, Buffalo Bird.

Kirtland, Ohio Geol. Surv., 1838, 162, 180.

It is hard to find anything good to say about this lazy tramp. He is, unfortunately, common all summer over the entire state, so that nowhere can the other birds find refuge from his depredations. We may have small pity for the stupidity of the other birds in permitting the alien egg to remain in their nests to work the destruction of their own young, but how different are we when we find a poor human waif which somebody may be too lazy to care for? Some birds, particularly the larger ones, do throw the egg out of their nest, but few of the smaller ones seem to make any effort to free themselves of the incubus. The presence of a young Cowbird in the nest of a species which is smaller than the Cowbird, frequently results in the death of the rightful inhabitants of the nest, and so great damage is done in the destruction of really beneficial birds.

There are perhaps two good things about the Cowbird. It eats the insects and grubs which are more or less injurious to cattle, and which are found in the pastures among the herds, and its flesh is good to eat! Cowbird and English Sparrow should find their way to the bill of fare of our hotels. They are dainty tidbits. Call them Ricebirds if you prefer.

The Cowbird reaches Ohio during the middle of March and returns south late in October. It frequently associates

with the Bronzed Grackles in their roosts during the summer and autumn, and may sometimes be found in the northward moving flocks made up of the several species of "Blackbirds." During the summer it is found in companies of five to eight individuals, both males and females, about the woodlands and pastures.

179. (498.) *AGELAIUS PHŒNICEUS* (Linn.). 117.
Red-winged Blackbird.

Synonyms: *Agelæus phœnicus*, *Icterus phœnicus*, *Oriolus phœniceus*.

Swamp Blackbird, Red-winged Starling, Red-and-buff-shouldered Marsh Blackbird, Blackbird.

Kirtland, Ohio Geol. Surv., 1838, 162.

This is probably the most familiar bird of the swamps and marshes in all parts of the state, where it nests in large numbers. In some regions where its natural nesting places of rushes and cat-tails have disappeared on account of drainage, it has gone into the clover fields and meadows. In others it has taken to the brush.

The testimony of the examination of large numbers of stomachs of this bird shows that it may prove harmful in some places and under some circumstances, but that its harmfulness is about one-eighth, as represented by the grains which it eats. The harmful insects and weed seeds which it destroys should far outweigh any damage done to agriculture. No doubt a large part of the grain eaten is waste grain.

The Red-wing is one of spring's harbingers. He reaches Ohio not far from the first of March, but is inclined to be a few days later than the Bluebird and Robin. When the season is late he may come in a large flock of "Blackbirds," but earlier he seems to prefer to travel with a small company of his own kind only. Like the other birds of his color he loves company, and after the young are able to fly, a whole swamp full select a place to spend the nights, which may be with the other species, or possibly a roosting-place exclusively of his own species. The most of our Red-wings

have gone south by the last of October, but a few remain well toward December, especially in the southern counties.

180. (498a.) *AGELAIUS PHENICEUS FORTIS* Ridgway.
Thick-billed Red-wing.

There is a specimen in the Oberlin College collection which seems clearly to belong to this new race. It was taken October 25, 1890, by C. A. Kofoed, at Oberlin. Apparently this form should be found among the early spring and late autumn Red-wings. The form has been so recently elaborated that it has not been possible to examine specimens in the different collections.

181. (501.) *STURNELLA MAGNA* (Linn.). 118.
Meadowlark.

Synonyms: *Sturnus ludovicianus*, *Sturnella ludoviciana*, *Alauda magna*.

Fieldlark, Old Fieldlark, Meadow Starling, Marsh Quail.
Kirtland, Ohio Geol. Surv., 1838, 162.

Like the Crow, Meadowlark may remain in small numbers in the northern part of the state all winter. Long continued cold, and particularly snow, will usually drive all south, or into some region not covered by snow. In the southern counties, decreasingly northward, it is a regular winter resident. No doubt the present condition of the Meadowlark is due to the clearing away of the forests, but unlike the Bobolink, it does not require so extensive fields and therefore probably found natural clearings in the forests possible breeding grounds before the appearance of the white settlers. If so his numbers were far less than now.

There should be no note of condemnation for this bird. His services in the meadow and fields cannot be estimated in values. Even during the winter insects comprise a large proportion of his food, while practically no grain that could be saved is eaten at any time. To say that 73 per cent. of the whole amount eaten is insects, a large part of which eat grains, is telling but half of the story. Being a ground haunter, the insects destroyed are such as the other birds

do not touch. It is therefore one of the birds which should be rigidly protected.

182. (506.) *ICTERUS SPURIUS* (Linn.). 119.
Orchard Oriole.

Synonyms: *Oriolus spurius*.

Kirtland, Ohio Geol. Surv., 1838, 162.

The Orchard Oriole is a fairly common summer resident throughout the state. In Lorain county it has increased, during the last ten years, from scarcely more than casual to fairly common. Writing in 1882, Dr. Wheaton states that in the vicinity of Columbus, at least, it resorts to "the low banks of sparsely wooded streams and willow thickets," preferring such places to orchards. In Lorain county it is more often found in orchards than elsewhere.

The birds are not numerous enough to figure economically, but if they were their food would be found to consist largely of insects injurious to fruit. The birds probably eat some ripe fruit in its season, but so little of it as to be of no consequence. Ripe mulberries are eaten with a good deal of relish.

The Orchard Oriole reaches our southern border during the last week in April and spends nearly a week in traversing the state, seldom appearing at Oberlin before the first of May. Its departure southward is a little uncertain, but seems to be about the middle of August.

183. (507.) *ICTERUS GALBULA* (Linn.). 120.
Baltimore Oriole.

Synonyms: *Icterus baltimore*, *Oriolus baltimore*, *Coracias galbula*.

Golden Robin, Hangnest, Firebird, Peabird, Hanging-bird.
Kirtland, Ohio Geol. Surv., 1838, 162.

This is the common Oriole throughout the state, and is apparently on the increase in most sections. It is one of the first birds which the would-be bird student sees and hears, because it comes into the door-yard to nest, and sings fear-

lessly. Its pendant nest is a familiar sight on almost every street, after the leaves have fallen.

Its food consists largely of injurious insects, particularly caterpillars and the small plant and bark lice which are overlooked by most other birds. It is true that some ripe fruit is eaten, but so little, usually, that little harm is done. A mulberry tree will prove a safeguard from anything which the Baltimore Oriole might be inclined to do with other fruit, for he does love ripe mulberries.

This Oriole reaches our southern border early in the last week of April, and loses little time in crossing the state, passing south about September 5, in the northern, and the 10th in the southern counties. A few individuals may linger well toward October.

184. (509.) *SCOLECOPHAGUS CAROLINUS* (Müll.). 121.
Rusty Blackbird.

Synonyms: *Scolecophagus ferrugineus*, *Quicalus ferrugineus*,
Oriolus ferrugineus, *Turdus carolinus*.
Rusty Grackle, Thrush Blackbird.

Kirtland, Ohio Geol. Surv., 1838, 162.

The little known Rusty Blackbird is a regular migrant across the state both spring and autumn, usually fairly common but seldom, if ever, very prominent. In the southern counties it is a tolerably common winter resident. As a migrant it could do no harm if it would, except possibly to the ripe corn crop. There is no evidence that it is ever harmful.

It is among the earlier spring birds, arriving during the first week in March and remaining until the end of the first week in May, returning again about the middle of September and remaining well into November, in the north. There is one record for February 13, 1897, when a female was shot in the marshes on Lake Erie. It must have wintered there.

185. (511b.) *QUISCALUS QUISCULA ÆNEUS* (Ridgw.). 122.
Bronzed Grackle.

Synonyms: *Quiscalus purpureus* var. *æneus*, *Q. versicolor*, *Q. purpureus*, *Q. æneus*.

Crow Blackbird, Common Blackbird, Purple Grackle, Bronzed Crow Blackbird, Brass Grackle, Western Crow Blackbird.

Kirtland, Ohio Geol. Surv., 1838, 162, 180.

This is the common "Blackbird" of lawns and shade trees. Its steel-blue head and neck and bronze-colored body would at once distinguish it from the other blackbirds. Dr. Wheaton states that it is "Found everywhere, but is especially numerous in sycamore groves along streams, and in oak woodland." I am not aware that it is now found breeding away from the immediate vicinity of human habitations. It is particularly numerous at farm dwellings where Lombardy poplars are numerous, and in towns and parks among the evergreen trees. It also roosts in the shade trees in parks and along the streets where shade trees form a sufficiently thick growth.

There can be no question that this species does more good than harm the whole year through, but that is not saying that the birds should always be left to do as they choose. It is too true that during the fall, when the small grains are standing in shock and the corn is in the milk, the grackles do great damage, sometimes descending in immense flocks upon a field, filling themselves with the grain. They also eat ripe fruit to some extent. During the spring they are decidedly beneficial in ridding the newly turned soil of grubs and other insect larvæ. The farmer must be his own judge and execute his sentence—if he can.

The Bronzed Grackles reach northern Ohio during the first week in March, not seldom with the other first spring birds. At Oberlin the arrivals usually fly first to the trees in which the roost was selected the previous summer, and then station themselves about town to suit their own fancy. The bulk of individuals leave for the south about November 10, but stragglers remain into December, or rarely all winter long.

Family FRINGILLIDÆ. Finches, Sparrows, Buntings, etc.

Of this group there have been found in Ohio 33 species native to North America, and one imported species. Only one other family of birds exceeds this in number of species, and probably none exceeds it in the numbers of individual birds, for the sparrows are always numerous. These birds are also among the most puzzling to the average student. Their food habits are given under each species.

186. (514.) *HESPERIPHONA VESPERTINA* (Coop.). 84.
Evening Grosbeak.

Synonyms: *Coccothraustes vespertina*, *Fringilla vespertina*.
Kirtland, Ohio Farmer (newspaper), IX, 1860, 91.

Dr. Wheaton knew of but one record for this northern species, in the reference given above. A female was taken by Mr. Charles Pease, Jr., and several others were seen by Dr. Kirtland, a few days previous to March 24, 1860. There was a small flight southward during the latter part of January, 1890, when a specimen was secured by Dr. Carl Tuttle, of Berlin Heights, Erie county, January 30, 1890; a number were seen by Mr. A. Hall, of Cleveland, and by Rev. J. M. Keck, in Lake county. At best it is a rare winter visitor to northern Ohio.

187. (515.) *PINICOLA ENUCLEATOR LEUCURA* (Müll.). 85
Canadian Pine Grosbeak.

Synonyms: *Pinicola enucleator*, *Corythus enucleator*, *Pinicola canadensis*, *Loxia enucleator*.

Kirtland, Am. Journal Sci. and Arts, XIII, 1852, 218.

The records of the occurrence of this northern bird are few, and, except Audubon's inferential reference to specimens captured at the mouth of the Big Guyandotte, in West Virginia, are confined to northern Ohio. Dr. Wheaton gives three records, two besides Audubon's. Dr. Kirtland recorded it from near Cleveland, and the statement by Mr. Read that it is "rare, though occasionally seen during most of the year," seems to me a decidedly questionable

record. Possibly the Purple Finch was meant. The only other records that I have are one by Mr. A. Hall, of Cleveland, who captured a specimen, date not known, and one by myself in Lorain county, January 1, 1902. It seems likely that more activity in field work during the winter would result in other records of this interesting species.

188. (517.) *CARPODACUS PURPUREUS* (Gmel.). 86.
Purple Finch.

Synonyms: *Fringilla purpurea*.

Purple Grosbeak, Crimson Finch, Linnet.

Kirtland, Ohio Geol. Surv., 1838, 164, 184.

The Purple Finch is a regular, but hardly common, migrant, and less numerous winter resident in all parts of the state. With us it occurs in small flocks, frequently associated with Goldfinch. In Lorain county it is too irregular to make any definite statements about its appearance in spring or autumn worth anything. Singing individuals have been recorded after the middle of May, and as early as the first of September.

While in the state the food of this species is not such as to affect agricultural interests, if it ever does. I have seen it breaking off and scattering the buds from trees, working at the pine cones, and eating weed seeds from near the ground.

189. (521.) *LOXIA CURVIROSTRA MINOR* (Brehm.). 87.
American Crossbill.

Synonyms: *Loxia curvirostra* var. *americana*, *L. curvirostra*, *Curvirostra americana*, *Curvirostra minor*.

Common Crossbill, American Red Crossbill, Red Crossbill.

Kirtland, Ohio Geol. Surv., 1838, 164, 184.

This Crossbill is an irregular winter visitor, and possibly breeds occasionally. Its appearance and disappearance are unaccountable. It has appeared at Oberlin during early autumn and been common both in the village and surrounding region until the following June, and then disappeared completely for months or years. Considerable flights some-

times occur during the winter or early spring only, followed abruptly by total disappearance. It may be found anywhere in the state where coniferous trees furnish food. Mr. E. A. Doolittle informs me that flocks are present now (late June) at Painesville. I have found a flock at Oberlin during the last week in June, 1903.

I have never seen the birds feeding on anything but pine nuts which are taken from the cones either on the trees or as they lie on the ground.

190. (522.) *LOXIA LEUCOPTERA* Gmel. 88.
White-winged Crossbill.

Synonyms: *Curvirostra leucoptera*.

Wheaton, Ohio Agri. Report, 1860, 346, 366.

This Crossbill is rare in Ohio. There appear to have been three flights, of which we have records, which may have reached Ohio. One was in 1868-9, when Dr. Langdon found considerable numbers of them associated with the Red Crossbills in the proportion of two of the White-winged to one of the other, in the vicinity of Cincinnati. Another flight mentioned by Mr. A. W. Butler (*Birds of Indiana*, 921) occurred in 1883-4, when numerous Indiana records were made, but apparently no Ohio records have come to light for this flight. The third and last occurred during the winter of 1901-2, when a flock remained near Elyria, Lorain county, for at least two weeks early in January, 1902. Other records are scattering and probably do not have to do with large flights. At best the species is irregular, requiring unusual weather and food conditions to be forced south.

191. (528.) *ACANTHIS LINARIA* (Linn.). 89.
Redpoll.

Synonyms: *Ægiothus linaria*, *Fringilla linaria*.

Red-poll Linnet, Common Red-poll, Lesser Red-poll.

Kirtland, Ohio Geol. Surv., 1838, 164, 183.

The Redpoll is probably a little less rare than the last

species, but it has ceased to be the "Tolerably regular winter resident in northern Ohio" that Dr. Wheaton knew. During my ten years' residence in Oberlin I have never seen it, in spite of many winter days spent afield in search for it. The rare occasions when it does cross Lake Erie are notable ones, for then the birds are among the most numerous of winter birds. Stragglers may be found occasionally. One was taken by Mr. Charles Dury in January, 1869, at Cincinnati.

The Redpoll feeds much after the fashion of the Goldfinch, the flock taking possession of a weed and apparently cleaning out the seeds before leaving, twittering all the while. They are not wary and allow a close approach.

192. (529.) *ASTRAGALINUS TRISTIS* (Linn.). 90.
American Goldfinch.

Synonyms: *Chrysomitris tristis*, *Fringilla tristis*, *Carduelis tristis*, *Spinus tristis*.

Yellow-bird, Thistle-bird, Lettuce-bird, Salad-bird, Wild Canary.

Audubon, Orn. Biog., 1831, 172.

Goldfinch is one of our commoner birds the year through, but during the colder part of the year—from October to April—he is known as a common sparrow, by the majority of persons, because his bright yellow and deep black dress has given place to drab only tinted with yellow. He has lost his cheerful, rollicking song, also, substituting a conversational twitter while he feeds or flies. During the more inclement weather flocks of Goldfinches take refuge in the woods, where they feed upon such weed and grass seeds as may be found there in the more open places. At other times they range the fields for food. Goldfinches and Tree Sparrows are frequently found in flocks together, both in woods and open fields.

The winter food of Goldfinch consists largely of weed and grass seeds taken from standing weeds and grass. In summer and autumn thistle seeds are much in favor, as they are in winter if there are any left. Insects are

eaten and fed to the young during July and August, with some seeds after the young are able to digest such hard food. The great usefulness in destroying quantities of weed seeds cannot be questioned. If he ever does damage I have not heard of it.

193. (533.) *SPINUS PINUS* (Wils.). 91.
Pine Siskin.

Synonyms: *Chrysomitris pinus*, *Fringilla pinea*, *Linaria pinus*.
Pine Linnet, Pine Finch American Siskin.

Storer, Proc. Bost. Soc. Nat. Hist., II, 1845, 52.

The Pine Siskin has certainly decreased in numbers since Dr. Wheaton knew it in 1882, when he regarded it as abundant. It is reported as rare from the southern, and only locally common from the central portion of the state. In the northern counties, particularly those touching Lake Erie, it may frequently become common during the autumn and spring, less so during winter. There is no authentic record of its breeding in the state, unless Dr. Kirtland's circumstantial evidence of mating and presence in June and July, 1850, be so considered. He states that both old and young appeared for three successive years early in July. No nests were found.

I have never found the Pine Siskin before the first week in September nor later than the first week in May in Lorain county. It is not always present all winter, but may be. I have found it usually associated with Goldfinch feeding with them and like them, but occasionally in small flocks by themselves feeding in the pine and cedar trees and hemlocks.

194. (534.) *PASSERINA NIVALIS* (Linn.). 92.
Snowflake.

Synonyms: *Plectrophanes nivalis*, *Emberiza nivalis*, *Plectrophenax nivalis*.

Snow Bunting, Snowbird, White Snowbird.

Audubon, Orn. Biog., II, 1834, 515.

Snowflake seldom appears in northern Ohio before the

new year opens. It could hardly be called common, in the usual acceptance of that term, at any time, because the birds band themselves together in greater or lesser flocks and are not found in any other fashion. The flocks range over considerable territory, appearing and reappearing at any one place but few times during the winter. The flocks may range from a few to several hundred individuals. Rarely single birds may be found with the flocks of Horned Larks or Lapland Longspurs. The species is less and less numerous as one proceeds southward from the lake shore, becoming only occasional in southern Ohio, in exceptional weather.

Feeding wholly on the ground, Snowflake picks up such seeds as may have been dropped or missed by the other sparrows. When the ground is completely covered with snow they are driven to feed upon the standing weed tops which project above the snow. A favorite feeding-place is a railroad track, where grains of wheat and oats sift through the cars and afford easy picking.

The Snowflakes are strictly winter birds, seldom appearing before the country is well snow-bound, or they drive down just in front of a blizzard to give fair warning. They are gone before April, usually not long after the first of March.

195. (536.) *CALCARIUS LAPPONICUS* (Linn.). 93.

Lapland Longspur.

Synonyms: *Plectrophanes lapponicus*, *Centrophanes lapponicus*, *Fringilla lapponica*.

Wheaton, Ohio Agri. Report, 1860, 366.

Dr. Wheaton's statements regarding this winter species still hold good for practically all of the state, except that I would not term it common at any time. "The first to appear are single birds, in company with Shore Larks. Afterward they may be seen in compact flocks of from ten to thirty, frequenting old brick-yards, and fields where cattle are fed, in company with Shore Larks, with which they associate on the ground, but fly by themselves in close flocks.

Frequently when first flushed they utter a rapid rattling note." To this we can fully agree.

The first severe winter weather marks their appearance, which is about the first of December, in the vicinity of Oberlin. I have seen flocks as late as April 23.

The food is chiefly weed and grass seed and grain, with a little insect food intermingled, even in winter. The birds are strictly beneficial.

196. (540.) *POECETES GRAMINEUS* (Gmel.). 95.

Vesper Sparrow.

Synonyms: *Pœcætes gramineus*, *Fringilla graminea*.

Bay-winged Bunting, Grass Finch, Gray-bird, Vesper-bird, Ground-bird.

Kirtland, Ohio Geol. Surv., 1838, 164.

This is our common "Ground Sparrow" so called. It does not disdain a perch on a fence, nor even a tree, but is more often found skulking or running on the ground in the grass. The first part of its song is a weak imitation of Meadowlark's usual song. The bird may be readily recognized by its two white outer tail feathers.

The food of the Vesper Sparrow varies with the season. While it remains in the state it eats more insects than vegetable matter, but during the winter it eats seeds and grain almost exclusively. During the warmer part of the summer its diet is 90 per cent. insect. A large part of the grain eaten is undoubtedly gleaned from the stubble, and would be wasted if the sparrow did not find it, or spring up in next year's cornfield only to make trouble. The good done in the destruction of injurious insects is greater than that of any other sparrow. Add to this the weed seeds destroyed during the autumn and you have a strong case for this sparrow.

Vesper Sparrow reaches Oberlin during the last week in March, and is common on the day of arrival, singing lustily. In a few days the numbers have greatly increased until almost every other bird seen is of this species. They literally swarm over the fields and pastures. As the migrations progress the numbers are reduced somewhat, but all

summer long it is an abundant species. The bulk of individuals has gone south by the first of October, but scattering individuals may remain well into November.

197. (542a.) *PASSERCULUS SANDWICHENSIS SAVANNA*
(Wils.). 94.

Savanna Sparrow.

Synonyms: *Passerculus savanna*, *Ammodramus sandwichensis savanna*, *Fringilla savanna*.

Common Savanna Sparrow.

Wheaton, Ohio Agri. Report, 1860, 366.

Judging from the reports that have come to me, this is not a common species, certainly not "Very common," as Dr. Wheaton found it. The apparent rarity may well be due to unfamiliarity. I have not found it even common in Lorain county; a half-dozen records for the season is unusually good success. I have utterly failed to find this bird in summer. Rev. Mr. Henninger reports it as common during the migrations, but a rare breeder in southern Ohio (Scioto and Pike counties). In the nature of the case, it must be of local distribution. It is a great skulker in the grass and may easily escape notice.

This, with other sparrows of the genus, prefers insects to seeds and grain, while they are with us. This sparrow in particular is the greatest of all beetle-eaters. Weevils and other destructive species form a large part of its diet during June, July, and August. The seeds eaten are weed seeds that we are anxious to get rid of, and the grain is almost wholly waste, since these birds do not go in flocks, but skulk about rather than expose themselves to view.

The Savanna Sparrow appears in southern Ohio during the first week in April, and has reached our northern counties a week later (March 21, 1903). It leaves us about the last week in October.

198. (546.) *COTURNICULUS SAVANNARUM PASSERINUS*
(Wils.). 96.

Grasshopper Sparrow.

Synonyms: *Coturniculus passerinus*, *Ammodramus savannarum passerinus*, *Fringilla passerina*.

Yellow-winged Sparrow, Quail Sparrow, Cricket Sparrow.

Kirtland, Ohio Geol. Surv., 1838, 164.

This little sparrow is local in its distribution, but may be fairly common in suitable regions, over the entire state. Its diminutive size and weak voice serve to hide it from all but the unusually interested. It seldom essays a higher perch than the top of a fence-post, and is usually content with a weed stalk or bunch of grass. It nests on the ground in meadows or neglected fields.

The food consists of insects and weed seeds and grain, but almost half of the whole food consists of injurious insects, and the grain is waste. The seeds are wholly of injurious weeds and grasses. As a destroyer of injurious insects this sparrow leads all the sparrows and equals some of the larger birds, like the Robin, which are supposed to feed largely upon insects and worms.

It appears in Ohio during the last week in April and remains until the first of October. During this time it must be looked for on the uplands, not in low places.

199. (547.) *AMMODRAMUS HENSLOWII* (Aud.). 97.

Henslow Sparrow.

Synonyms: *Coturniculus henslovii*, *C. henslowi*, *Emberiza henslovii*.

Henslow's Bunting, Henslow's Grasshopper Sparrow.

Jones, Auk, XII, 1895, 241.

Dr. Wheaton gives it in his catalogue of 1882, citing references to Audubon, Birds Am., III, 1841, 76, and his own publications based upon Audubon's statement and upon a supposed specimen which Dr. Wheaton collected in the vicinity of Columbus in 1856, which proved to be the young of *A. s. passerinus*. Dr. Wheaton eliminates these records and says, "In all probability Henslow's Bunting will be found not uncommon in restricted localities, particularly in the

southern and western portions of the state." It seems, therefore, that the reference given above should stand as the first published record for the state. During the entire summer of 1894 this sparrow was found in considerable numbers about Oberlin, and several specimens were taken. I have looked for it in vain every year since then. There are no other reports of its occurrence within the state.

200. (549.1.) *AMMODRAMUS NELSONI* (Allen). —.
Nelson Sparrow.

Synonyms: *Ammodramus caudacutus nelsoni*.
Nelson's Sharp-tailed Sparrow.

To Mr. Robt. J. Sim, of Jefferson, belongs the honor of adding this interesting bird to our state list. The bird was captured in the vicinity of Geneva, Ashtabula county, on May 17, 1902, and sent to me for identification. It proved to be a fine specimen in full spring dress. When captured the bird was on a bit of high, almost barren ground which lies between two arms of the extensive marsh near the lake shore. It seems probable that this secretive bird may be found sparingly throughout the state in suitable places.

201. (552.) *CHONDESTES GRAMMACUS* (Say). 98.
Lark Sparrow.

Synonyms: *Chondestes grammaca*, *Fringilla grammaca*.
Lark Finch.

Wheaton, Field Notes, I, 1861, 129.

The appearance and spread of this, one of the most beautiful singers among the sparrows, is very interesting. Dr. Wheaton records the first ones seen in 1861. In 1882 it had spread well over the southern half of the state, at least as far as the Scioto river, but was not known north of the central portion. In 1890, when I came to Oberlin, it was not known in Lorain county, but two years later Mr. L. M. McCormick found it on the Vermilion river bottoms. Since that time it has been found regularly, but in small numbers in the western half of the county, and has also reached

Cleveland. Mr. I. A. Field has found it not uncommon at Granville and at Licking reservoir. It has not been reported from the eastern third of the state, but may be found there within a few years.

This is one of the great grasshopper-eating sparrows. During its stay it eats almost no grain, but does eat grass, clover and weed seeds, and numbers of weevils, besides the grasshoppers. It is therefore deserving of protection, and should never be persecuted.

It does not reach Ohio before the first of May, and is gone again early in September. It must be looked for in fields bordering woods, where it nests on the ground.

202. (554.) ZONOTRICHIA LEUCOPHRYS (Forst.). 99.
White-crowned Sparrow.

Synonyms: *Fringilla leucophrys*, *Emberiza leucophrys*.

White-browed Sparrow, White-browed Crowned Sparrow,
White-crowned Bunting.

Audubon, Orn. Biog., II, 1834, 88.

There is little danger of confusing this with the next species in the spring; but far more in the autumn when the black head stripes of spring have given place to brown, and the white is reduced to gray. A little careful attention will discover the difference between them at any time.

In Lorain county we look for the White-crowns in the brush fringing woods. Sometimes the White-throats may invade their favorite places, but I have never found them invading the thickets which the White-throats regard their own. This species is strictly migratory, and has never been known to breed in Ohio, although Dr. Kirtland recorded them in July, 1850, near Cleveland.

While with us the food consists of vegetable matter three-fourths to the animal matter one-fourth. Of the vegetable matter but a small proportion is grain, and a good proportion of that is probably waste. Some fruit is eaten during the summer, but none during the southward journey, or so little as to amount to nothing. The animal food is about a third caterpillars, the rest being ants, wasps, beetles and

but few grasshoppers. It would thus appear that this sparrow is deserving of protection for the large numbers of weed seeds destroyed, and for its part in keeping in check the insect pests.

The White-crowned Sparrow reaches Ohio during the first five days of May and remains nearly two weeks. It returns again early in October and remains about two weeks.

203. (558.) ZONOTRICHIA ALBICOLLIS (Gmel.). 100.

White-throated Sparrow.

Synonyms: *Fringilla pennsylvanica*, *F. albicollis*.

White-throated Crown Sparrow, Peabody-bird, White-throat,
Yellow-browed Sparrow, Bush Sparrow.

Kirtland, Ohio Geol. Surv., 1838, 164, 183.

If the White-crowned Sparrow be considered common during its migrations the White-throat is abundant usually. There is no direct evidence that it ever breeds in the state. It prefers the brushy tangles bordering woods, but may be found in almost any brushy places away from woods, particularly if it be abundant. It associates with Song, Field and Vesper Sparrows more or less, and with Juncos sometimes. The clear, whistled call or song may rarely be heard during the southward movement, but is given full-voiced during the northward one. To one familiar with the bird its alarm call is characteristic.

Weed seeds comprise half of what this sparrow eats, only 3 per cent. is grain; about 30 per cent. is wild fruit in the season of fruit. The insects eaten are chiefly harmful species. The debt is therefore wholly on our side of the account.

The White-throat reaches northern Ohio from its winter sojourn in the southern counties, early in April and remains well into May. It returns again late in September and remains about five weeks.

204. (559.) *SPIZELLA MONTICOLA* (Gmel.). 101.
Tree Sparrow.

Synonyms: *Spizella montana*, *Fringilla canadensis*, *F. monticola*.

Winter Chippy, Winter Chip-bird, American Tree Sparrow, Canadian Sparrow.

Kirtland, Ohio Geol. Surv., 1838, 164.

Tree Sparrow is by far our most abundant winter bird. It ranges both woods and fields, cleaning up every weed patch in the country. It lives in flocks of from ten or a dozen to several hundred individuals, and not infrequently sings in the dead of winter. One could not watch a flock of these birds for five minutes and retain a fit of the "blues." In the coldest and stormiest weather they find something to be happy about.

These birds seem to have a preference for grass seed, and will clean up anything that may be left exposed. But surely no thrifty farmer will leave his millet or timothy shocks out all winter long. In the absence of cultivated grasses great quantities of injurious grass seeds are destroyed. Only two per cent. of animal matter is eaten, hence the service of these birds lies in the weed seeds destroyed.

They reach Ohio about the beginning of the second week in October and remain until the middle of April, or sometimes even into the last week of April.

205. (560.) *SPIZELLA SOCIALIS* (Wils.). 102.
Chipping Sparrow.

Synonyms: *Spizella domestica*, *Fringilla socialis*.

Chippy, Chip-bird, Hair-bird, Chipping-bird, Chipper.

Kirtland, Ohio Geol. Surv., 1838, 164.

This sociable little bird is one of the door-yard birds which must be well known to all who take any interest in their feathered visitors. He may nest in the vine which covers the trellis, if not disturbed; or at least in one of the ornamental trees in your yard, or in the grape-vine. Some have supposed that this and the Tree Sparrow were the same, but this sparrow goes south in winter. It is really

abundant during the entire summer throughout the state.

The food consists of 62 per cent. vegetable to 38 animal matter. Only 4 per cent. of the food is grain, and there seems to be no evidence that any fruit is eaten. Of the 38 per cent. of animal food a large part consists of the caterpillars of some of our most injurious insects. In large part these are such insects as other birds do not find because they are afraid to come so near human habitations. Although not larger than your thumb, this little bird is among the most useful of our sparrows.

It may be a resident in the southern counties, unless the weather is too severe. In northern Ohio it appears close to the first of April, but does not become common before the last of the month. The last ones leave the lake shore about the middle of October.

206. (563.) *SPIZELLA PUSILLA* (Wils.). 103.

Field Sparrow.

Synonyms: *Fringilla pusilla*, *F. juncorum*, *Spizella agrestis*.

Wood Sparrow, Bush Sparrow, Field Chippy, Red-billed Chippy, Feo-feo.

Kirtland, Ohio Geol. Surv., 1838, 164.

The Field Sparrow is really a bush-haunting sparrow, and is not infrequently called the brush sparrow. The brush fringing woods is the favorite haunt of this species. Brushy pastures are usually full of them and their nests. Their peculiar accelerando song is characteristic of such places.

The food habits and food are very similar to those of Chipping Sparrow. Both deserve strict protection.

The Field Sparrow spends the entire winter south of Ohio, and returns during the third week in March, rarely earlier. It remains well into October, and may linger until November in the extreme southern part of the state.

207. (567.) *JUNCO HYEMALIS* (Linn.). 104.
Slate-colored Junco.

Synonyms: *Fringilla hyemalis*.

Snowbird, Eastern Snowbird, Black Snowbird, Common Snowbird, Junco, White-bill.

Kirtland, Ohio Geol. Surv., 1838. 164, 183.

This "Snowbird" is a winter resident over the whole state, but is not usually common during January and February in the extreme north. When it is present during these months it is pretty closely confined to the deeper stream gorges, where it finds food, and protection from the cold winds. In the central and southern parts of the state it may be found with the flocks of Tree Sparrows and Goldfinches, well scattered over the country. There it may pass the night in the corn shocks.

During the winter Junco eats weed and grass seeds almost exclusively, only nine per cent. of its entire food being animal. There is so little grain eaten that it does not figure. Hence the Junco is a great aid to the agricultural interests in the destruction of weeds.

Junco appears in northern Ohio about the first of October and within a week has made his way to our southern border. He leaves that border about the middle of April, often later, but tarries along the lake shore until the first of May.

208. (575a.) *PEUCÆA ÆSTIVALIS BACHMANII* (Aud.). —
Bachman Sparrow.

Synonyms: *Fringilla bachmanii*.

Oak-woods Sparrow.

Henninger, Bulletin Michigan Orn. Club, II, 1898, 7.

The first specimen was captured by C. M. Weed, August 18, 1890, at Columbus. The specimens reported by Rev. Mr. Henninger in the above reference were taken on April 23, and a second observed on May 3, 1897, at South Webster. Miss Laura Gano reports several on April 27, and later, on Grosbeck Hill, Avondale, and College Hill, Cincinnati. Leander S. Keyser sends a questionable record for Clarke county. The invasion has been from the south-

west, with an apparent intention of remaining to possess the state. Let us hope so.

209. (581.) MELOSPIZA CINEREA MELODIA (Wils.). 105.
Song Sparrow.

Synonyms: *Melospiza fasciata*, *M. melodia*, *Fringilla melodia*, *F. fasciata*.

Silver-tongue.

Kirtland, Ohio Geol. Surv., 1838, 164.

Next to the Chipping Sparrow, this is probably our best known sparrow (always omitting mention of Britain's constant representative). It is present during the entire year in all parts of the state, but, unlike Junco, is far less common in the northern third in winter than elsewhere, and far less than it is during the summer. In summer it lives in the brushy tangles bordering woods and swamps, or the fields where weeds are allowed to grow, or even the back yards in the more thinly settled parts of towns and villages. In winter it loves brush piles in the woods, provided there is a good supply of food at hand. It is also found in some numbers in the thick tangle of grass and sedges bordering the swamps and bogs. It begins to sing early in February if there be bright days. The early spring songs differ from the later ones.

Only six per cent. of the food of this sparrow could possibly be of any use to man, while the weeds and injurious insects destroyed are something enormous in quantity when the abundance of the species is considered. It is true that its increasing familiarity tends to develop in it a taste for ripe fruits and more grain, but the useful things destroyed are so completely overbalanced by the good it does that we can afford to freely forgive and forget.

The great increase in the numbers of this sparrow in Lorain county occurs about the first of April; then large numbers arrive from the south and swell the numbers already here.

210. (583.) *MELOSPIZA LINCOLNII* (Aud.). 107.
Lincoln Sparrow.

Synonyms: *Fringilla lincolnii*.

Lincoln's Finch, Lincoln's Song Sparrow.

Wheaton, Ohio Agri. Report, 1874, 566.

Little seems to be known of this sparrow. Its close resemblance to Song Sparrow probably causes it to be confused with that species. It is nowhere common in the state, even during the height of the migrations. It does not breed with us, but passes north. I have usually found it in low brushy woods, rarely in the fields bordering woods. It skulks about in the grass and weeds more than the Song Sparrow, and has a very different song. One would not confuse the two a second time. Rev. Mr. Henninger regards it as common during the migrations in Scioto county.

It arrives in southern Ohio early in April, but Lorain county records all fall in May. It is not unlikely that the birds passing up the Scioto river are earlier than those which travel overland to reach Lorain county. The birds stay but a few days and pass north. In the autumn they return late in September or early in October.

211. (584.) *MELOSPIZA GEORGIANA* (Lath.). 106.
Swamp Sparrow.

Synonyms: *Melospiza palustris*, *Fringilla palustris*, *F. georgiana*.

Swamp Song Sparrow, Spotted Swamp Sparrow.

Kirtland, Ohio Geol. Surv., 1838, 164.

The Swamp Sparrow is so much confused with the Song and other brush-haunting sparrows that it is difficult to determine its exact standing. Judging from the reports it is not common during the migrations. It is reported as breeding near Circleville, by Dr. Howard Jones, who found a nest in May, 1881, which contained five eggs. The bird was shot.* I have looked for it in vain from Cleveland to Sandusky on the lake shore, in summer. My own experience with it would indicate that it is fairly common during

*Illustrations of the Nests and Eggs of Ohio Birds, p. 186.

the spring migrations in Lorain county. It frequents rather wet woods which are much grown with brush, as well as the more swampy places.

In food habits this sparrow is not injurious, but its preference for swampy places, where it feeds upon the insects and seeds, does not give it a high standing as a beneficial species. However, it must be classed as one of the sparrows which does more good than harm.

This sparrow reaches Lorain county about April 21, and remains until about the middle of May, returning again late in September for ten days or two weeks.

212. (585.) *PASSERELLA ILIACA* (Merr.). 108.

Fox Sparrow.

Synonyms: *Fringilla iliaca*.

Eastern Fox Sparrow, Fox-colored Sparrow, Rufous Sparrow.

Kirtland, Ohio Geol. Surv., 1838, 164.

This is a common migrant both spring and autumn. It is found in the brushy woods in company with the other sparrows which haunt such places, but it seems to feel an aloofness to them. It is rather slow and sedate in carriage, not skulking in the brush piles as much as the others.

Fox Sparrow is fond of millipeds in April, and eats many ground beetles during that month also. Of the 86 per cent. of vegetable matter which constitutes its food, some 30 per cent. consists of the seeds of fruit. The remaining vegetable matter is largely seeds of ragweeds and polygonum. While some of the insects are useful, and possibly some of the fruit is cultivated, the destruction of weed seeds is so large that the birds perform a great service to agriculture.

This is one of the early spring sparrows, arriving at Oberlin about the middle of March and remaining five weeks. It returns again during the last week in September, or the first week in October, and remains a month.

213. (587.) *PIPILO ERYTHROPHthalmus* (Linn.). 109.
Towhee.

Synonyms: *Fringilla erythrophthalma*.

Towhee Bunting, Chewink, Ground Robin, Marsh Robin, Red-eyed Towhee, Jewee, Joree, Pink-pink, Wink, Wink-wink, Pipilo, Turkey Sparrow.

Kirtland, Ohio Geol. Surv., 1838, 164.

Towhee is a resident over most of the state, but in small numbers north. It is likely that the resident birds are males while the females are more migratory. In northern Ohio the winter birds must be looked for in well protected places where food is easily obtainable. During the summer the Towhee may be found in almost any thicket bordered woods, or in the lower brushy second growth. I have found nests in the higher, more open woods, as well as in the brushy tangles. No one who visits the woods can have failed to make the acquaintance of this strong-voiced bird.

The food habits do not seem to have been carefully investigated, but from the structure and general habits one might infer that this rather unsparrow-like sparrow feeds more after the fashion of the Robin. Such insects as haunt the ground are eaten in considerable quantities, as well as the weed seeds that may be found in the woods. It is certainly true that Towhee is useful as a weed destroyer.

The migrating females reach southern Ohio about the middle of April and depart about the middle of November. The migrating males reach Oberlin about the middle of March, and but few remain after the first of November.

214. (593.) *CARDINALIS CARDINALIS* (Linn.). 110.
Cardinal.

Synonyms: *Cardinalis virginianus*, *Fringilla cardinalis*, *Pitylus cardinalis*, *Loxia cardinalis*.

Cardinal Redbird, Crested Redbird, Top-knot, Redbird.

Audubon, Orn. Biog., II, 1834, 366.

Cardinal is now a common resident over the entire state. Ten years ago it was scarce in Lorain county, and even now is far less numerous at the lake shore than twenty miles

south. Lately it has appeared at London, Ontario. Clearly it is extending its range from year to year. With more thorough protection it will soon become one of our most familiar birds.

This large, strong beaked bird is made for a diet of seeds which most other sparrows could not crush. I sometimes wonder what the birds which apparently spend all their time in towns and villages find to eat there. But there are always gardens with more weeds than vegetables. Weed seeds must form a large proportion of its food, with a small proportion of insects and fruit. I have yet to hear complaints about the destructiveness of this brilliant plumaged bird. Its loud, clear whistled calls and song are familiar to most persons, whether they go into the woods or not.

Away from towns and villages the birds are thicket haunters. They are often more numerous along the courses of streams than elsewhere, especially during the winter.

215. (595.) *ZAMELODIA LUDOVICIANA* (Linn.). 111.
Rose-breasted Grosbeak.

Synonyms: *Goniaphea ludoviciana*, *Fringilla ludoviciana*, *Coccothraustes ludoviciana*, *Guiraca ludoviciana*, *Hedymeles ludoviciana*, *Habia ludoviciana*.

Rose-breasted Song Grosbeak, Rose-breast, Redbreast, Red-breasted Song Grosbeak, Red-breasted Grosbeak, Potato-bug Bird.

Audubon, Orn. Biog. II, 1834, 166.

The Rose-breasted Grosbeak is hardly common as a migrant in the southern half of the state. It is a summer resident in the northern half, but is rare as far south as Columbus, and not common at the lake shore. It is not infrequently seen among the shade trees bordering village streets, and may nest in the parks if not persecuted. Its favorite nesting-place is a woods in which there are patches of second growth or large bushes. Briar patches and brushy tangles do not seem to offer many inducements.

The "gross" beak is adapted for crushing strong seeds, upon which it feeds to a large extent. It is also accused of eating ripe fruit. I have seen it eating the buds from

trees. The birds are not numerous enough to be of much use or harm, but they are certainly more useful than harmful.

These grosbeaks reach Oberlin close to the first of May and remain until the middle of September.

216. (598.) *CYANOSPIZA CYANEA* (Linn.). 112.

Indigo Bunting.

Synonyms: *Passerina cærulea*, *Passerina cyanea*, *Fringilla cyanea*, *Tanagra cyanea*.

Indigobird, Indigo Painted Finch, Indigo Painted Bunting, Indigo Bluebird, Blue Linnet, Green Linnet, Indigo, Green Bird, Blue Nonpareil.

Kirtland, Ohio Geol. Surv., 1838, 164, 183.

The Indigobird is a common summer bird over the entire state, being almost abundant in some places. It is fond of any sort of thicket, from the brush fringing woods and weedy briar tangles to the rank vegetation bordering streams, marshes, and ponds, where it breeds.

Its food is similar to that of the Field Sparrow, with which it lives in perfect harmony. It is therefore one of the more useful of sparrows, of great service to agriculture because it is so numerous.

It reaches the state about the first of May and stays until October.

217. (604.) *SPIZA AMERICANA* (Gmel.). 113.

Dickcissel.

Synonyms: *Euspiza americana*, *Fringilla americana*, *Emberiza americana*.

Black-throated Bunting, Little Meadowlark, Little Field Lark, Judas Bird, Judas Iscariot.

Kirtland, Ohio Geol. Surv., 1838, 164, 183.

Dr. Wheaton's statement that this species is an "Abundant summer resident from May to September, in Middle and Southern, less common in Northern Ohio," hardly applies now. It is fairly common, and locally abundant, east to Licking county, and north to Columbus, but is rare north to Cleveland, and seems to be wholly unknown east of Cleveland. It is more numerous in the northwestern part

of the state than east of Toledo. It is a summer resident wherever it occurs, living and nesting in the fields much after the manner of the Meadowlark.

Unlike most of the sparrows, Dickcissel eats more than twice as much animal matter as vegetable matter. Of the vegetable matter only three per cent. is grain, the rest being weed seeds. Of the animal matter fully half of all food eaten is grasshoppers and crickets. A small percentage of useful insects is eaten, but it is so small a proportion that no account of them need be taken. This is, therefore, one of our most useful summer sparrows.

Rev. Mr. Henninger states that it is a rare summer resident in both Pike and Scioto counties where it has been unknown until within the last six years.

Family TANAGRIDÆ. Tanagers.

Only one of the two members of this family found in Ohio is distributed over the entire state. Both have brilliant plumage, and both are fairly good singers. While they are woods-haunting birds, the Scarlet Tanager frequently nests in parks and shade trees in cities and towns.

218. (608.) *PIRANGA ERYTHROMELAS* Vieill. 82.

Scarlet Tanager.

Synonyms: *Piranga rubra*, *Tanagra rubra*, *P. erythromelas*.

Black-winged Redbird, Pocket-bird, Scarlet Sparrow, Canada Tanager, Red Tanager, Scarlet Black-winged Tanager.

Kirtland; Ohio Geol. Surv., 1838, 164.

In spite of his brilliant dress, and in spite of the fact that he is one of our common birds in every part of the state, there are many persons who do not know the Scarlet Tanager. When chance throws him so directly in their path that they must see him, he is heralded as the rarest of birds dropped down from —Limbo! How many there are who, having eyes, see not! There is no part of the state where this is not a common summer resident. It sometimes nests in our city and village parks, well up among the branches.

This bird destroys insects, weed seeds, and eats wild

fruit. I have seen it cutting the tender buds from elm trees and eating them. It is not injurious in any way, and is of considerable service to the farmer.

The Scarlet Tanager reaches Ohio about the first of May, frequently earlier; and returns to the south late in September.

219. (610.) *PIRANGA RUBRA* (Linn.). 83.

Summer Tanager.

Synonyms: *Pyranga æstiva*, *Tanagra æstiva*, *Fringilla rubra*.

Summer Redbird, Rose Tanager, Red Bee-bird, Flaxbird,

Redbird, Mississippi Tanager, Variegated Tanager.

Audubon, Orn. Biog., I, 1831, 232.

The distribution of this southern species in our state is rather remarkable. It is found in Trumbull, Portage and Columbiana counties in the east, but does not go beyond Franklin in the center nor Montgomery in the west, except casually. It thus appears to remain close to the Ohio river or its main tributaries. Its northeast range appears to be due to a recent movement, since Dr. Wheaton says nothing about it. There is no direct evidence, except the northeast movement, that its range is being much extended. No doubt there will be records of individuals from further north, as our activity in field work increases, but any considerable extension of its range in the next half century does not seem likely.

The deep ravines and gorges of the southeastern and southern parts of the state seem to be the favorite abiding places of this not very brilliant tanager. During a boating trip down the Muskingum and Ohio rivers, from Zanesville to Ironton, with my friend and fellow bird student, Rev. William Leon Dawson, during August of 1902, we found these birds at almost every stop below Marietta. They are not uncommon about McConnellsville, where Messrs. C. H. Morris and E. J. Arrick have found them nesting, but we were not fortunate in finding them during our stay there. Mr. Arrick well described the peculiar call note, which was often heard along the Ohio river, by the

syllables, *cluckity chuckity chuck*, or *chuckity tuckity tuck*.

This tanager's food is like that of the Scarlet Tanager—insects, varied by frequent helps of weed seeds and wild fruits in their season. It is distinctly useful.

It seems to slightly precede the Scarlet Tanager in its arrival, appearing during the last week in April and tarrying well into September.

Family HIRUNDINIDÆ. Swallows and Martins.

Five swallows and one martin spend the summer in Ohio. These birds pass most of their days on the wing feeding and playing. The martins are less active on the wing, but are good flycatchers nevertheless. All of this family not only rival but exceed the true Flycatchers as destroyers of flying insects, usually feeding upon the insects which fly higher or in the more open fields. Some glean from the top of the grass as they fly. A large colony of swallows under the eaves of a stock barn is the best friend of the milkman.

220. (611.) PROGNE SUBIS (Linn.). 76.

Purple Martin.

Synonyms: *Hirundo purpurea*, *H. subis*, *Progne purpurea*.

Martin, Purple Swallow, Black Martin, Black Swallow, Great American Martin, Blackbird Swallow.

Kirtland, Ohio Geol. Surv., 1838, 162.

Dr. Wheaton reported this as an "Abundant summer resident." If abundant anywhere now it is not so reported. There may still be a few colonies where large numbers of individuals breed. I have seen more at Lewiston reservoir, where we found them nesting in the stumps projecting above the water, than elsewhere. But even here they were not abundant. It seems clear that twenty years have served to greatly diminish their numbers over the entire state. What the cause of this decrease may be is hard to determine. Many have declared that since both Martins and English Sparrows use the bird-houses, and since the sparrows are on hand all winter, the Martins find their homes preëmpted when they return, and are unable to regain possession. If,

as we are told by Dr. W. B. Barrows in his report upon the English Sparrow, the sparrows are successful in driving the Martins away only half of the time, that would fully account for the decrease in numbers. There can be little question that at least a part of the decrease must be attributed to the sparrow.

It should not be necessary to state that the food of the Purple Martin consists largely of flying insects. During the time the young are fed the old birds are driven to search the ground as well as the air for grasshoppers and other large insects to appease the appetite of the always hungry young ones. Their services to mankind will only be appreciated when they are gone and nothing takes their place as destroyers of the insects which cause us so great annoyance.

The Martin not infrequently reaches our southern border during the second week in March, and the lake shore during the third week. It moves south again about September 15. Rev. Mr. Henninger reports an albino at South Webster, Scioto county, March 29, 1895.

221. (612.) PETROCHELIDON LUNIFRONS (Say.). 77.
Cliff Swallow.

Synonyms: *Hirundo fulva*, *H. lunifrons*.

Eave Swallow, Crescent Swallow, Mud Swallow, Mud Dauber, Square-tailed Barn Swallow, White-fronted Swallow, Rocky Mountain Swallow, Republican.

Bonaparte, I, 1825, 65.

The Cliff Swallow nests in colonies, and is therefore common and may be abundant in a few places. It is hardly common in Lorain county. There is no record of a colony nesting away from human habitations in Ohio since its settlement by civilized people. Their favorite nesting-place is under the eaves of a barn or other similar building, often in companies of several hundred, where the building affords enough room. The flask-shaped mud nests are familiar to every farm boy.

Like the other swallows, the Cliff Swallow feeds upon

the insects that fly a good deal, catching them in mid-air. These swallows are much liked by intelligent stock farmers and dairymen, for they keep in check the flies that annoy the herds and milch cows.

The Cliff Swallow appears at Oberlin during the last week in April. It leaves its nesting-places early in July and is gone south by the last of September.

222. (613.) *HIRUNDO ERYTHROGASTER* Bodd. 78.

Barn Swallow.

Synonyms: *Hirundo rufa*, *H. horreorum*, *H. erythrogaster* var. *horreorum*, *Chelidon erythrogastra*.

Fork-tailed Barn Swallow, American Barn Swallow, House Swallow.

Kirtland, Ohio Geol. Surv., 1838, 162.

This is the most common and familiar of our swallows, always remembering that the Chimney Swift is not a swallow. While it is not in such great numbers as the Vesper Sparrow, it may be fairly called abundant in practically all parts of the state as a summer resident. It nests in barns or almost any large out-building, or unused house; or under bridges. There is no record of the nests of this species under cliffs or in caves, as its habit was before civilized man appeared in America. In Oberlin the Barn Swallow is a familiar bird, nesting in any barn that may be left open for it. One may see them flying about the streets catching insects at any time of day, during the summer.

This swallow frequently gleans from the grass tops, as it skims along without apparent effort. House flies are also eaten, as well as the species of dancing flies which annoy the wheelman.

The appearance of Barn Swallows in spring largely depends upon the weather. They are such strong fliers that they may venture north for a single day early in March, during one of the spring-like days which are pretty sure to come, or they may tarry south until early April. The most have gone south by the first of September, but individuals usually remain until the last week in September.

223. (614.) *IRIDOPROCNE BICOLOR* (Vieill.). 79.

Tree Swallow.

Synonyms: *Hirundo bicolor*, *Tachycineta bicolor*.

White-bellied Swallow, Blue-backed Swallow, Field Swallow,
River Swallow, Wood Swallow, Green-blue Swallow,
Black-and-white Swallow.

Kirtland, Ohio Geol. Surv., 1838, 162.

Dr. Wheaton reported this as a "Very common summer resident." The only place where I have found it abundant was at Lewiston reservoir in July, where the birds swarmed about the multitudes of stumps in which they nested. Not even the English Sparrow ventured to disturb them there. In late July and early August the Tree Swallows roost in our northern marshes at night, or line the telegraph wires which pass such localities. They are abundant enough then, but where they have come from is a mystery. Certainly not from the immediate region, for they are not found except in small numbers during the summer. A few are willing to occupy the bird boxes erected for them and the Martins and Bluebirds, but most of them prefer to cling to their primitive habits of nesting in hollow trees.

The food differs from that of the other members of this group only in the difference in insects which naturally inhabit such regions as these swallows frequent a part of the year. During the weeks when the swallows are collecting for their southward journey they roost together in mixed companies of the several species, but one species usually predominates.

The Tree Swallows arrive and depart with the Cliff Swallows.

224. (616.) *CLIVICOLA RIPARIA* (Linn.). 80.

Bank Swallow.

Synonyms: *Cotyle riparia*, *Hirundo riparia*, *Riparia riparia*.

Sand Martin, Sand Swallow.

Kirtland, Ohio Geol. Surv., 1838, 162.

The Bank Swallow shifts its breeding-places to suit local conditions and therefore may be reported as common at one

locality for a term of years and afterward wholly absent. The banks in which it burrows to rear its brood are constantly changing, sometimes wholly disappearing. Railroad cuts furnish suitable places for a short time, and then become unfitted by the caving of the perpendicular banks to form a sloping bank. River banks and the clay banks facing Lake Erie are not alike two years in succession. Where a colony of some 200 pairs of the Bank Swallow nested for three years not one is to be found now. The bank caved off back of the nests twice in succession during the same spring, both times after many nests had been finished and the eggs deposited. That was too much for the swallows. Now there is but one large colony in Lorain county on the lake shore, but there are several small colonies. At the lake shore the birds might justly be called decidedly common, but elsewhere in the county they are scarce. Before the spread of the English Sparrows into the country hamlets Bank Swallows nested in the shale cliffs on Vermilion river, but now the sparrows occupy all of the available nesting-places.

With the restriction that this swallow may be found where cliffs or banks afford nesting-places, and not over the country generally, it may be called common over the entire state, during the summer. It is, of course, locally common.

Bank Swallow reaches the lake shore about the beginning of the last week in April, leaves its nesting-places early in July, and has gone south by the middle of September.

225. (617.) *STELGIDOPTERYX SERRIPENNIS* (Aud.). 81.
Rough-winged Swallow.

Synonyms: *Cotyle serripennis*, *Hirundo serripennis*.

"Bank Swallow," Rough-wing.

Kirkpatrick, Ohio Farmer, VIII, 1859, 290.

This species is so little known, probably because of its resemblance to the Bank Swallow, that reports are meager. Dr. Wheaton says, "Next to the Barn Swallow, this appears to be our most abundant species." Judging from my own

observations in several representative places in the state, such is not the case now. The term common better applies. These birds may be found about bridges, perpendicular rocky cliffs, and sometimes in company with the Bank Swallow, with which it nests to a limited degree. I have never seen it in such large companies as the Bank Swallow, but six to ten birds together is not uncommon. The nest is usually made in a crevice of the rocks, and is not made by the birds, although it may be cleared of loose earth or rubbish.

The food is not much unlike that of the other members of this group. It may be seen swinging back and forth over the fields or up and down a rock walled stream, usually feeding below the top of the cliffs.

The Rough-wing arrives a few days later than the Bank Swallow, and does not leave the streams before the middle of July. It has gone south by the first of September.

Family AMPELIDÆ. Waxwings.

Both waxwings have been found in Ohio, only the Cedar regularly. They are almost silent birds, having no true song and but a weak chatter. They are erratic in habits, usually occur in flocks, and frequently nest in our orchards. Their plumage is soft and delicate. The conspicuous crest is a good field mark.

226. (618.) *AMPELIS GARRULUS* Linn. 74.

Bohemian Waxwing.

Synonyms: *Bombycilla garrula*, *Lanius garrulus*.

Bohemian Chatterer, Northern Chatterer, European Chatterer, Waxen Chatterer, Northern Waxwing, European Waxwing.

Kirtland, *Am. Journal Sci. and Arts*, XL, 1841, 20.

There is nothing to add to what Dr. Wheaton has said about this winter bird. From that account it appears that the species was a somewhat regular winter visitor in the vicinity of Cleveland to about 1860. Since that time I have been unable to find records for Ohio. It is just possible that

the bird does reach our northern border sometimes still, but is not distinguished from the Cedar Waxwing. Observers should be on the watch during our cold weather, and especially be suspicious of any Waxwing which appears during such severe cold.

Dr. Kirtland states that these birds were "attracted by the berries of the mountain ash and hawthorn, and the fruit of the persimmon."

227. (619.) *AMPELIS CEDRORUM* (Vieill.). 75.

Cedar Waxwing.

Synonyms: *Bombycilla carolinensis*, *B. cedrorum*.

Cherry Bird, Cedar Bird, Carolina Waxwing, Southern Waxwing, Little Waxwing, Carolina Chatterer, Spider-bird.

Kirtland, Ohio Geol. Surv., 1838, 162.

This is a somewhat irregular species, but may be considered a common resident over the entire state. However, it is sometimes scarce or wholly wanting from some localities and abundant at others during the same time. It is generally seen in flocks even during the nesting season.

Its food consists of 13 per cent. animal and 87 vegetable matter. A few snails are eaten, but the bulk of the animal matter consists of beetles, with a few bark and plant lice. The vegetable matter is 87 per cent. wild fruit and seeds and only 13 per cent. cultivated fruits, with the probability that a large part of the raspberries and blackberries are also wild fruit. Early cherries are scarcely touched. At any time the Cherry-bird prefers mulberries to cherries. A single bearing mulberry-tree has saved a whole orchard of cherries. A Cherry-bird was brought to me which had killed itself by eating too many ripe mulberries. Taken the year through this bird is far more useful than harmful and should be protected.

Family LANIIDÆ. Shrikes.

The name "Butcher-bird" was applied to members of this family because of their habit of impaling their victims upon thorns. It was long supposed that they gloated over the

struggles and sufferings of their victims like veritable barbarians. That this is a libel on the character of the shrikes any one may prove by studying them at first hand. They are pretty fair singers, but the summer form is seldom heard singing unless one happens upon the performer unobserved. The Northern Shrike sings from his tree-top perch in the midst of a snowstorm in midwinter. All shrikes are solitary birds except while nesting and for some time after the young have left the nest.

228. (621.) *LANIUS BOREALIS* Vieill. 72.

Northern Shrike.

Synonyms: *Lanius septentrionalis*, *Collyrio borealis*, *Collurio borealis*.

Great Northern Shrike, Butcher-bird, Great American Shrike, Great Butcher Shrike.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

This solitary shrike is a winter resident over the entire state, but it is irregular south and rare everywhere, except occasionally along the lake front. It visits towns and villages during extreme weather for the sake of the hordes of English Sparrows. In the fields and woods it is always on the lookout for field mice or other rodents, and unwary sparrows.

The food of this bird consists of birds 35 per cent., insects 40 per cent., mice 25 per cent. Of the birds many are English Sparrows. While the other birds are useful species they constitute less than 25 per cent. of the whole food. It seems clear, therefore, that, contrary to his reputation, the Butcher-bird is one of our useful winter visitors and should be encouraged to visit the settlements where English Sparrows are to be so easily found. The habit of impaling its victims on thorns has grown out of the necessity of storing food against a time of scarcity, and is not an indication of the savage or barbarous instincts so often attributed to these birds.

The Northern Shrike reaches northern Ohio about the first of October and the southern counties a week later. It sometimes tarries until the first of April in Lorain county.

229. (622d.) *LANIUS LUDOVICIANUS MIGRANS* W. Palmer. 73 and 73a.
Migrant Shrike.

Synonyms: *Lanius ludovicianus*, L. l. *excubitorides*.
Loggerhead Shrike, White-rumped Shrike.

W. Palmer, Auk, XV, 1898, 257.

Awaiting the action of the A. O. U. committee on nomenclature upon the proposed subspecies *migrans*, there seems nothing left one but to accept this tentative name instead of reverting to the former now obsolete names, so far as the shrikes of Ohio are concerned. In the Oberlin College collection there are a few more specimens referable to *L. ludovicianus excubitorides* than to *L. ludovicianus*, with two or three specimens indeterminate. With such a condition illustrated by specimens taken within a few miles of Oberlin, this proposed creation of a new subspecies which shall eradicate the confusion hitherto so apparent, seems desirable. At any rate it is not wise to return to the old classification. The two names used by Dr. Wheaton will therefore refer to this new subspecies. It is clear from Dr. Wheaton's remarks that his mind was not at rest concerning the summer shrikes. The apparent shifting westward of the *excubitorides* form noted by him, and by Prof. Ridgway in Illinois, was not satisfactorily accounted for.

The food of this shrike differs from that of the Northern only in the larger percentage of insects eaten and the smaller percentage of birds. While feeding its young many snakes are killed, and many of the spiny caterpillars. Grasshoppers are eaten in quantities. It is clear, from the careful study of the food of this bird, and from the examination of stomachs, that it is far more beneficial than injurious, and should be protected at all times.

It appears certain that this form winters as far north as Columbus in small numbers. It is hardly common anywhere in the state, except locally. The southeastern counties are too deeply gashed and are so lacking in suitable nesting-places that it is practically absent from that region.

This shrike reaches northern Ohio about the middle of March and returns south about the first of October.

Family VIREONIDÆ. Vireos.

Of the six vireos found in Ohio four remain to breed, and one of the four is found only in the southern parts of the state. These birds closely resemble the warblers in habits and carriage, but are more deliberate in their movements, and glean from leaves rather than from the twigs and stems, but they must sometimes make sallies into the air for flying insects, and frequently act like warblers. They usually sing all the time between mouthfuls, and may be known by their songs even when other characteristics fail. For the most part they are sober-colored, one species having a yellow throat. Their colors are shades of gray with some green and yellow. In contrast to the warblers, they are not patchy in color.

The vireos are preëminently leaf gleaners, but they sometimes catch flying insects after the manner of the warblers. Their food is therefore more largely eggs and larvæ of insects than the winged forms. It is just possible that they may take a little ripe fruit in its season, but if so, in too small quantities to count.

230. (624.) VIREO OLIVACEUS (Linn.), 66.
Red-eyed Vireo.

Synonyms: *Vireosylvia olivacea*, *Muscicapa olivacea*.

Red-eyed Greenlet, Red-eyed Flycatcher, Red-eye, Preacher-bird.

Kirtland, Ohio Geol. Surv., 1838, 163.

This vireo is almost abundant in woods throughout the state. Its perpetual phrased song is likened to the admonitions of a preacher, and has given it the name of "Preacher Bird." Its woven pensile nest is an easy mark for the Cowbird, which is pretty sure to deposit one or more of its parasitic eggs in the nest. I have found three eggs of the Cowbird and but two of the rightful owner in one nest. The

duped vireo seems to offer no protest to this persistent imposition. The birds are not confined to the woods, but frequently nest in our city parks. The noise of traffic may almost completely drown the cheerful voice, but it cannot stop it.

This vireo reaches the lake shore about the 23d of April and departs about the 25th of October.

231. (626.) VIREO PHILADELPHICUS (Cass.). 67.
Philadelphia Vireo.

Synonyms: *Vireosylvia philadelphica*.

Brotherly Love Vireo, Brotherly Love Greenlet.

Baird, P. R. R. Report, IX, 1858, 335.

This vireo seems to be irregular as a migrant in Ohio. I have never found it in Lorain county, nor elsewhere in the state. If it were even fairly common it could hardly have escaped so many observers entirely.

Rev. Mr. Henninger found it late in April and again late in September, in southern Ohio.

232. (627.) VIREO GILVUS (Vieill.). 68.
Warbling Vireo.

Synonyms: *Vireosylvia gilva*, *Muscicapa gilva*.

Warbling Greenlet, Warbling Flycatcher.

Kirtland, Ohio Geol. Surv., 1838, 163, 180.

This is the vireo which lives in the shade trees and parks all summer. It is almost abundant over the entire state. The peculiar rolling song and rasping scolding notes must be familiar to all. They may be heard just outside your door at almost any time from May to August.

This vireo seems to travel with the Red-eyed Vireo, sometimes arriving a day or two earlier. Southern Ohio dates of arrival range from April 19 to May 9, while Lorain county arrivals range from April 28 to May 1. They have left the lake shore by September 15, but tarry a month longer in the southern counties.

233. (628.) VIREO FLAVIFRONS Vieill. 69.
Yellow-throated Vireo.

Synonyms: *Vireosylvia flavifrons*, *Lanivireo flavifrons*.
Yellow-throated Greenlet.

Kirtland, Ohio Geol. Surv., 1838, 163.

Most people are not acquainted with this vireo, probably because it prefers the taller timber and is seldom seen about human habitations. It is hardly common as a summer resident except in certain localities where tall oak timber is plentiful. Its song closely resembles the song of the Red-eyed, but may be readily distinguished after careful study of both.

This species arrives during late April, perhaps a little later than the two foregoing species, and remains until September.

234. (629.) VIREO SOLITARIUS. (Wils.). 70.
Blue-headed Vireo.

Synonyms: *Lanivireo solitarius*, *Muscicapa solitaria*.
Solitary Vireo, Solitary Greenlet, Blue-headed Greenlet.

Wheaton, Ohio Agri. Report, 1860, 365, 375.

Like the Yellow-throated Vireo, this is little known, partly because it seldom gets out of the woods, and partly because it is strictly a migrant across the state. Its song has a fairly close resemblance to the song of the Red-eyed Vireo, but it is not difficult to distinguish after a little study. I have found the Blue-headed on the College campus and in the shade trees lining our streets.

This vireo reaches Lorain county the first week in May, usually near the first; or even the last days of April, is fairly common for a week, and passes north about the 15th of May. It returns about the middle of September, remaining but a short time. It leaves southern Ohio shortly after the middle of October. A better acquaintance with this bird will undoubtedly prove it to be not uncommon during the migrations across the state.

235. (631.) VIREO NOVEBORACENSIS (Gmel.). 71.
White-eyed Vireo.

Synonyms: *Muscicapa noveboracensis*.

White-eyed Greenlet, Little Green Hangingbird, Chickity-beaver, Politician, Hanging Flycatcher, Green Flycatcher. Kirtland, Ohio Geol. Surv., 1838, 163.

The White-eyed Vireo is distinctly southern in its distribution, in Ohio. It is a fairly common summer resident in the southern half of the state, ranging at least to the southern border of Franklin county, but Dr. Wheaton did not find it at all at Columbus, nor have others found it there as more than a casual visitor. In the eastern half of the state it ranges north into Cuyahoga and Ashtabula counties, being fairly common at Jefferson all summer. There is no record for Lorain county. I did not find it in Medina county, where the conditions are unusually favorable, nor at either the Licking or Lewiston reservoirs. Dr. Wheaton regarded it as of local distribution over the state. If that be true at the present time evidence is lacking.

It reaches our southern border early in May and retires southward early in September.

Family MNIOTILTIDÆ. Wood Warblers.

The species of this family found in Ohio are both the most numerous and the most interesting of birds. Thirty-six species are regularly found, one has wandered from the east, and two belong to the Hypothetical List of the A. O. U. He who can resist the temptations to get into the woods which "Warbler Time" brings is hopeless from an ornithological standpoint! Most of them pass through the state twice each year, but fully fifteen species remain to breed while three others occasionally do. Some of the species which nest well north in the state in small numbers and are migrants elsewhere must be regarded as rare breeders, the most of the individuals passing well north to breed.

Most members of this group are insect eaters, but most of them also eat fruit and berries in their season, some of them to a considerable extent. Some are gleaners from leaf and

branch, some feed largely upon the ground, while some catch flying insects after the manner of the true Flycatchers. All are useful birds and none seem to be at all injurious.

236. (636.) *MNIOTILTA VARIA* (Linn.). 28.

Black and White Warbler.

Synonyms: *Mniotilta varia borealis*, *Sylvia varia*, *Motacilla varia*.

Black-and-white Creeper, Black and White Creeping Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

Dr. Wheaton gives this warbler as a "Common summer resident." It is so reported by a few observers well scattered about the state, but is regarded by most as common only during the migrations. My studies in different parts of the state have convinced me that it is to be found breeding in suitable places over the entire state, but is common only locally. It breeds sparingly about Oberlin. During the summer it must be sought in the deeper high woods. Its creeping habits and weak song make it an inconspicuous bird at best, and in the deep shadows of the woods it may be easily overlooked.

This warbler is among the first of the great host of warblers which pass across the state—a few of them remaining all summer—late in April and early in May. It appears on our southern border about April 25th, and our northern border about three days later. In Lorain county it is common up to the middle of May and then the few which remain to breed retire to the deeper woods. The last have left the county by the 25th of September.

237. (637.) *PROTONOTARIA CITREA* (Bodd.). 29.

Prothonotary Warbler.

Synonyms: *Motacilla citrea*.

Golden Swamp Warbler, Willow Warbler, Golden Warbler. Wheaton, Ohio Agri. Report, 1860, 363, 373.

The distribution of this handsome warbler is largely determined by the special conditions favorable to its breeding.

Dr. Wheaton says of it: "The Prothonotary Warbler is only known in this state as a summer resident in western Ohio, especially in the vicinity of St. Mary's reservoir." I have found it fairly common at Licking reservoir, in all three counties in which that reservoir lies; but it was not found at Lewiston reservoir in spite of the fact that breeding places seemed plentiful. In "Birds of Indiana," page 1022, Mr. Butler mentions a Cleveland record for this species. I have been unable to verify this record. Mr. Charles Dury reports its presence at Cincinnati and St. Mary's reservoir, as stated above. These are the only positive state records. It is likely that the bird occurs in other suitable localities in the state. Its local distribution is well illustrated by the finding of breeding birds in eastern Minnesota. There seems to be some indirect evidence that this species is extending its range northward where conditions are favorable.

I have no records of its migrations, but it must reach Licking reservoir early in May, for during the last week in May we found a nest which was the second for that pair of birds, the first having been robbed two weeks previously.

238. (639). *HELMITHEROS VERMIVORUS* (Gmel.). 30.
Worm-eating Warbler.

Synonyms: *Helminthoherus vermivorus*, *Sylvia vermivora*, *Helinaia vermivora*, *Motacilla vermivora*, *Vermivora pennsylvanica*.

Worm-eating Swamp Warbler, Worm-eater.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

Like the last species, this one is among those of more southern distribution. Dr. Wheaton regarded it as rare in summer. It now seems to be common in many places in the southern part of the state, and ranges well north in the eastern half, breeding in Cuyahoga and Ashtabula counties. There is a doubtful record for Lorain county. Without doubt this species is extending its range northward, and further study by trained men will no doubt greatly increase the Ohio records.

The Worm-eating Warbler reaches Ohio during the first

week in May and departs southward about the middle of September.

239. (641.) *HELMINTHOPHILA PINUS* (Linn.). 32.
Blue-winged Warbler.

Synonyms: *Helminthophaga pinus*, *Sylvia solitaria*, *Vermivora solitaria*, *Certhia pinus*.

Blue-winged Yellow Warbler, Blue-winged Swamp Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

This warbler is tolerably common during the migrations, but is less numerous as a breeding bird over the entire state. Given a wet woods with a fringe of brush and the Blue-wing is pretty certain to be present. One hearing of the curious song is enough to fix it in mind. While the nest is placed near the ground in the grass or rarely low bushes, the birds must usually be looked for in the tree-tops, or at least in the upper branches of the taller trees. If the bird be near the ground it is pretty certain proof of the presence of the nest.

This warbler reaches northern Ohio during the last week in April, and remains until the middle of September.

240. (642.) *HELMINTHOPHILA CHRYSOPTERA* (Linn.). 33.
Golden-winged Warbler.

Synonyms: *Helminthophaga chrysoptera*, *Sylvia chrysoptera*, *Vermivora chrysoptera*, *Motacilla chrysoptera*.

Blue Golden-winged Warbler, Golden-winged Swamp Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

The distribution of this warbler in Ohio seems to be almost identical with that of the Worm-eating Warbler, with the exception that it seems to be a little more northern. It has been found in Lorain county a half-dozen times, but is not known to have bred there. It is reported as breeding in Cuyahoga and Ashtabula counties, and is common locally in the southern half of the state. It also nests on the ground, but is not so fond of the tree-tops for a perch. It is unwary, permitting a near approach. Its lazily uttered *see see see see* is unlike the song of any other bird, but might be mistaken for an insect.

This Warbler reaches Lorain county during the first week in May. I have no autumn records of the return south. It probably tarries until the first of September at least.

241. (645.) *HELMINTHOPHILA RUBRICAPILLA* (Wils.). 34.
Nashville Warbler.

Synonyms: *Helminthophaga ruficapilla*, *Sylvia rubricapilla*,
Vermivora rubricapilla, *Sylvia ruficapilla*.

Nashville Swamp Warbler, Nashville Worm-eater.

Kirtland, Ohio Geol. Surv., 1838, 168, 182.

The Nashville Warbler is a common migrant, passing entirely across the state twice each year. It is not confined to the woods but is just as common in the parks and along the tree-lined streets, and in the door-yards among the fruit and ornamental trees, busily engaged in cleaning out the insect pests from bud and leaf.

This warbler reaches Lorain county about the first of May and is common for two and sometimes three weeks, often tarrying until the 23d of May. It returns in force early in September and remains about four weeks. There is little doubt that this is a late date for the return of this and many other warblers, but the records show no earlier dates.

242. (646.) *HELMINTHOPHILA CELATA* (Say). 35.
Orange-crowned Warbler.

Synonyms: *Helminthophaga celata*, *Sylvia celata*.

Wheaton, Ohio Agri. Report, 1860 363, 373.

Dr. Wheaton's statement that this is a "Rare spring and fall migrant" remains true to-day. The bird is little known. I have found it but a half-dozen times at Oberlin, and not more than one bird for each record. Once it was feeding in an orchard just out of the village, the other times in the woods low down in the brush.

My dates of spring migration fall within the first week of May. I have no autumn records.

- 243 (647.) *HELMINTHOPHILA PEREGRINA* (Wils.). 36.
Tennessee Warbler.

Synonyms: *Helminthophaga peregrina*, *Sylvia peregrina*, *Ver-mivora peregrina*.

Tennessee Swamp Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

This is probably the most numerous warbler of the shade trees and orchards during both spring and autumn migrations. It passes entirely across the state, none remaining to breed. In spring it literally swarms about our trees and lawns, but is unnoticed by the majority of people, because it is so small and because its song is so like that of the Chipping Sparrow, and some insects. In autumn it is more confined to the woods, but is not uncommon in orchards and shade trees. It is one of our best friends, gleaning everywhere for the eggs, larvæ or the perfect insects which do so great damage to fruit. Yet I have known of fruit growers who made war upon them for eating off the buds! They are after the bug that eats the bud or the fruit.

The Tennessee Warbler is among the later warblers to arrive, appearing about May 5, and remaining two weeks. It passes south again in September, leaving the state during the first week in October.

244. (648a.) *COMPSOTHYLPIS AMERICANA* USNEÆ Brewst.
37 (part).

Northern Parula Warbler.

Synonyms: *Dendroeca tigrina*, *Perissoglossa tigrina*, *Sylvia americana*, *Parus americanus*, *Compsothlypis americana* (part).

Blue Yellow-backed Warbler, Parula Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

Judging only from the specimens in the Ohio State University and Oberlin College museums, six in all, this form is pretty clearly a regular migrant across the state in spring, during the first two weeks of May. There appear to be no breeding specimens in collections. It is not common anywhere, but is fairly numerous during favorable years for the spring migrations of the warblers.

245. (648b.) *COMPSOTHTYPIS AMERICANA* RAMALINÆ.
Ridgway. 37 (part).
Western Parula Warbler.

The synonyms and reference should stand as in the preceding form. In "Birds of North and Middle America," Vol. II, 486, Prof. Ridgway gives the following reference: Read, Proc. Ac. Nat. Sci. Phila., vi., 1853. (n. Ohio). Mr. H. C. Oberholser also informs me that this is likely the breeding form for Ohio. A specimen in the Ohio State University collection, and one in the Oberlin College collection, both taken rather late for the migratory movement, are decidedly small. In the absence of contradictory evidence it seems necessary to regard this form as the Ohio breeding Parula Warbler. It is little known in the breeding season, having been noted only by Dr. Langdon and Mr. Dury near Cincinnati. It would appear to be a little later than the preceding form in its migrations.

246. (650.) *DENDROICA TIGRINA* (Gmel.). 38.
Cape May Warbler.

Synonyms: *Dendroeca tigrina*, *Perissoglossa tigrina*, *Sylvia maritima*, *Sylvicola maritima*, *Motacilli tigrina*.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

The Lorain county records for this warbler number less than a dozen, all in the first week of May. There are no reports of any greater number anywhere in the state in the spring migrations, but Rev. Mr. Henninger notes it as common during the autumn migrations in Scioto county, "especially in upland beech woods." It is strictly a migrant in the state, stopping but a short time in spring, but passing south more leisurely.

It reaches southern Ohio late in April, and northern Ohio a week later; returning about the middle of September, and may be found in Scioto county as late as October 3.

247. (652.) *DENDROICA ÆSTIVA* (Gmel.). 39.

Yellow Warbler.

Synonyms: *Dendroica æstiva*, *Sylvicola æstiva*, *Sylvia æstiva*, *Motacilla æstiva*.

Summer Warbler, Summer Yellowbird, Blue-eyed Yellow Warbler, Golden Warbler, Yellow-bird, Yellow-poll Warbler, Wild Canary.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

This well-known warbler is our commonest summer warbler in all parts of the state. It has the capacity of accommodating itself to almost any conditions, seeming as much at home in the orchard or ornamental trees as in its primitive briar tangle in some drying swamp. Its nest may be within a few feet of the ground or in the tree-tops if necessary. As an inhabitant of the orchards it is kept busy with the insect pests which make the life of the fruit-grower miserable. Here it is a great aid in keeping in check fruit destroying insects.

The Yellow Warbler is among the earlier warblers to appear in spring, reaching our southern border before the 20th of April, or even during the first week of April, in favorable years. It is usually found at Oberlin about the 22d of April, often earlier. The departure in the autumn is not so easy to trace. I have found them in Oberlin as late as September 7. It is likely that individuals remain much later but the majority have gone before the first of September.

248. (654.) *DENDROICA CÆRULESCENS* (Gmel.). 40.

Black-throated Blue Warbler.

Synonyms: *Dendroica cærulescens*, *Sylvia canadensis*, *Sylvicola canadensis*, *Dendroica canadensis*, *Motacilla canadensis*, *M. cærulescens*.

Canadian Warbler, Pine Swamp Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

This is one of the fairly common migrants, passing entirely across the state twice each year. It is as often seen in parks and along shaded streets in spring as in the woods, but seems to avoid human habitations on its return journey. It is an inhabitant of the lower stories of the woods, even

feeding upon the ground, when the white wing-spot is conspicuous against the blue-black wing.

It reaches southern Ohio as early as the 15th of April in favorable years, but seldom appears at Oberlin before the first of May. It remains about two weeks, and returns again early in September or even late in August, to remain until about the first of October.

249. (655.) *DENDROICA CORONATA* (Linn.). 41.

Myrtle Warbler.

Synonyms: *Dendroica coronata*, *Sylvia coronata*, *Sylvicola coronata*, *Motacilla coronata*.

Yellow-rumped Warbler, Yellow-crowned Warbler, Yellow-rump, Myrtlebird, Yellow-rumped Wood Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

This is an irregular warbler, sometimes being abundant and again hardly even common. It is the earliest to appear in spring and the latest to depart southward in autumn. It does not breed in the state as far as known. In its northward movement it is well distributed in the woods and parks, but in its southward journey it prefers to travel in the more open country, often with the Chipping Sparrow. At such times it may be seen in the fields gleaning among the weeds like a sparrow, or searching for insects in weed stems. It derives its name from its fondness for the berries of the myrtle (*Myrica cerifera*).

During the spring passage of this species the insect food is greatly in the preponderance, although even then myrtle berries are eaten when they can be found, but during the autumn passage southward, when the fruit of the myrtle is abundant, it has been determined that fully 62 per cent. of the food is the myrtle berries. It seems remarkable that a bird supposed to be an insect eater should feed so largely upon this particular fruit. The myrtle berries are good for nothing, while the insects eaten are injurious. It is clear that this warbler deserves protection equally with the other warblers.

The Myrtle Warbler appears in Lorain county about the

middle of April, depending on the weather at that time, and tarries until the middle of May, or later sometimes. It returns late in September and is fairly common until the 20th of October, scattering individuals remaining into the first week of November.

250. (657.) *DENDROICA MACULOSA* (Gmel.). 42.

Magnolia Warbler.

Synonyms: *Dendroeca maculosa*, *Sylvia magnolia*, *S. maculosa*,
Sylvicola maculosa, *Motacilla maculosa*.

Black and Yellow Warbler.

Wilson, Am. Orn., III, 1811, 63.

Dr. Wheaton says of this species, "Abundant and regular spring and fall migrant in middle Ohio, summer resident in small numbers in north-eastern Ohio." At the present time it is generally regarded as not common as a migrant, except occasionally, when it becomes common. I find no evidence that this warbler now breeds within the state. While few of us find the first warblers on their return in late July or early August, it is well known that they migrate as early as that. Middle of the summer specimens do not, therefore, indicate that the birds have bred in the vicinity. Late June records would more likely indicate breeding birds.

The Magnolia Warbler reaches northern Ohio early in May, and the last has passed north about May 21. It returns late in July or early in August, judging from the records, and remains until about September 20.

251. (658.) *DENDROICA RARA* Wils. 43.

Cerulean Warbler.

Synonyms: *Dendroeca cærulea*, *Sylvia azurea*, *S. rara*, *Dendroica cærulea*.

Azure Warbler, Blue Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

Dr. Wheaton's statement, "Abundant summer resident," no longer applies to this woods-haunting warbler. It is universally reported as not common during the summer. It would be hard to assign a reason for this decrease in num-

bers, since the places where the bird now nests are numerous enough for its purposes. True, it does not go out of the taller woods to breed, but it seems to find woods enough suitable for breeding places. It may be, however, that during the earlier days it was confined to the deeper woods and the rapid disappearance of them has driven many to other regions. In Lorain county it is to be found in every considerable woods, but is only common here.

The Cerulean Warbler arrives with the warbler host, about the first of May in northern Ohio, and is fairly common for two weeks. The departure northward of a majority of the individuals leaves the state thinly settled with Ceruleans. It passes south during the last week of September.

252. (659.) *DENDROICA PENNSYLVANICA* (Linn.). 44.
Chestnut-sided Warbler.

Synonyms: *Dendroica pennsylvanica*, *Sylvia icterocephala*, *Sylvicola icterocephala*, *Motacilla pennsylvanica*, *M. icterocephala*.

Quebec Warbler, Yellow-crowned Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

Of all the warbler host this is to me the most interesting, in its parti-colored dress and confiding ways. The day that brings them is the brightest day of the season. In their northward movement they are not particular about the places where they feed, provided the insects are numerous and the trees are not too far apart. Every year we see numbers of them on the College Campus. I have seen them in the dooryard, in the apple-trees, and in the deep woods among the highest branches. It is common only locally, apparently. Dr. Wheaton gives it as a summer resident in the north-eastern parts of the state. It is not unlikely that it still breeds in the northern part of the state, but if so it has not been so reported to me. None have been found in summer in Lorain county.

This is one of the warbler host which reaches Oberlin about the first of May, remaining about two weeks and then

passing north. It returns early in September and remains until the last week of the month.

253. (660.) *DENDROICA CASTANEA* (Wils.). 45.

Bay-breasted Warbler.

Synonyms: *Dendroica castanea*, *Sylvia castanea*, *Sylvicola castanea*.

Bay-breast.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

Apparently this warbler is not well enough known to make any statements of its spring migrations reliable. In Lorain county it is fairly common every spring, and usually more numerous in the autumn. That seems to be the general verdict, except that in many places the species is not at all common. The whole warbler group is perhaps less known by the average bird student than any other. The reason for this lack of acquaintance is not easy to explain, because the usually bright patchy coloring of these birds makes them somewhat conspicuous. Their small size and arboreal habits, and the difficulty of detecting them among the foliage, doubtless contribute largely to the difficulties.

This is among the later arrivals in spring, not appearing in Lorain county before May 5, generally, and has gone northward by the 23d. In its southward migrations it reaches Ohio about the middle of August, and tarries in the southern counties until the middle of October.

254. (661.) *DENDROICA STRIATA* (Forst.). 46.

Black-poll Warbler.

Synonyms: *Dendroica striata*, *Sylvia striata*, *Sylvicola striata*, *Muscicapa striata*.

Black-poll.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

This warbler arrives even a little later in spring than the Bay-breast, and is frequently associated with it. Judging from the reports it is a little more numerous in spring and fully so in the autumn. Fall specimens of these two warblers are so nearly alike that one not well acquainted with

them will probably not be able to distinguish between them in life. A good pair of field glasses, such as the 8-power prism glasses, usually makes their identification possible at a range of twenty-five yards. But under any circumstances close scrutiny is necessary to detect the tint of cream-buff on the underparts of the Bay-breast and the distinctly yellow tint of the same parts of Black-poll. Both species are wood birds, but they also feed in wooded parks within the city limits, at times. In their southward migrations they are partial to the hillsides bordering streams where the trees are not so tall.

The Black-poll does not reach Oberlin until after May 10, and remains but a week or ten days. It returns during the last half of August and does not leave our southern border before the 10th of October.

255. (662.) *DENDROICA BLACKBURNIÆ* (Gmel.). 47.
Blackburnian Warbler.

Synonyms: *Dendroica blackburniæ*, *Sylvia blackburniæ*, *Sylvicola blackburniæ*, *Motacilla blackburniæ*.

Hemlock Warbler, Orange-throated Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

Dr. Wheaton regarded this beautiful warbler as an abundant migrant. It appears to have decreased in numbers until it is only common in most parts of the state, and uncommon in others. At Oberlin it is usually common during both migration periods. It is a bird of the tree-tops, seldom descending below the middle story of the woods, unless the weather be inclement. It is one of the few birds which attract the attention of the casual passer whose eyes are ever raised above the ground. Its brilliant orange throat gleams like a sunbeam amid the foliage.

This winged Prometheus comes with the opening buds near May-day, usually after rather than before, and remains until the foliage hides him. During the first two weeks only males in brilliant dress may be found, but during the last week these have made way for the host of plainer colored females. The last are seen about May 22. The return

may be as early as the middle of August, the last passing south about September 25.

256. (663a.) *DENDROICA DOMINICA ALBILORA* Ridgw. 48.
Sycamore Warbler.

Synonyms: *Dendroica dominica* var. *albilora*, *Sylvia pensilis*,
Sylvicola pensilis, *Dendroica superciliosa*, *D. dominica*.
White-browed Yellow-throated Warbler, White-cheeked
Warbler.

Kirtland, Am. Journal Sci. & Arts, XL, 1841, 21. The first reference for the subspecific name as it now stands should be Ridgway, Am. Nat., VII, 1873, 606.

This species appears to breed sparingly across the state, but is known by few observers. I have never seen it. Dr. Wheaton states that it is the earliest of all the warblers in spring, even preceding the Myrtle. If it has passed through Lorain county it has entirely eluded careful search for a half-dozen years. It certainly does not breed in the western half of the county or it would have been found at some time. It has actually been found breeding at Cleveland, Mt. Vernon, Wauseon, and Cincinnati. More careful search for this early warbler should reveal its presence in many parts of the state where it is not now known even as a migrant.

Reliable migration dates are wanting, but it appears that the birds should be looked for early in April, and that some remain in the southern counties well into October. Sycamore groves appear to be the favorite places for these birds.

257. (667.) *DENDROICA VIRENS* (Gmel.). 49.
Black-throated Green Warbler.

Synonyms: *Dendroica virens*, *Sylvia virens*, *Sylvicola virens*,
Motacilla virens.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

Unlike the two following species, this one is among our commonest migrant warblers. Dr. Wheaton's designation of "Abundant spring and fall migrant," still applies. It is common in the woods, but seems to prefer the lawns, parks,

and shaded streets. At almost any hour of the day, during the first two weeks of May, several may be heard singing about the library building on the Oberlin College campus. It is no less numerous anywhere else in the state, judging from the reports.

In the spring migrations it reaches southern Ohio about April 25 and the lake shore about two days later; passing north about May 20, but often remaining several days longer, singing all the time. The first return during the latter part of August and tarry into the first week of October. It is just possible that a few pairs remain to breed in the northern counties.

258. (670.) *DENDROICA KIRTLANDI* Baird. 50.
Kirtland Warbler.

Synonyms: *Dendroica kirtlandi*, *Sylvicola kirtlandi*.

Baird, Ann. Lyc. N. Y., V. 1852, 217.

Our state enjoys the honor of furnishing the type specimens of this rare and little known species, and to Charles Pease belongs the coveted honor of securing that specimen. The state records should be brought down to date. The name of the collector, place and date are given.

Charles Pease, near Cleveland, May 13, 1851 (type).

R. K. Winslow, near Cleveland, June (May?), 1860.

Charles Dury, Cincinnati, first week in May, 1872.

W. and J. Hall, Rockport (Cuyahoga county), May, 1878.

H. E. Chubb, Cleveland, May 4, 1880.

H. E. Chubb, Cleveland, May 12, 1880.

L. S. Keyser, Springfield (?), 1891.

Lynds Jones, Oberlin, May 11, 1900.

Lynds Jones and W. L. Dawson, near Ironton, August 28, 1902 (two).

No other state can boast so many specimens, but Michigan is fast approaching us in numbers. Better acquaintance with the species and greater activity in field work will probably prove this supposably rare warbler not "The rarest of all the warblers."

259. (671.) *DENDROICA VIGORSII* (Aud.). 51.

Pine Warbler.

Synonyms: *Dendroeca pinus*, *Sylvia pinus*.

Pine-creeping Warbler, "Vigor's Vireo."

Wheaton, Ohio Agri. Report, 1860, 364.

This is another of the almost ornithological mysteries to the writer. I have found just one specimen in Lorain county, and that one an early migrant. It is reported as a rare migrant by most persons, but is reported on good authority as breeding in the southern part of the state. Dr. Wheaton did not know of any record of its breeding. Beyond doubt it should be one of the breeding warblers of the state. It needs careful looking after by competent field observers everywhere.

Migration dates are meager, but they indicate that this warbler makes its appearance late in April, and departs about October 10 from the southern counties.

260. (672.) *DENDROICA PALMARUM* (Gmel.). 52.

Palm Warbler.

Synonyms: *Dendroeca palmarum* var. *palmarum*, *Sylvia petechia*, *Sylvicola ruficapilla*, *Motacilla palmarum*.

Red-poll Warbler, Red-poll.

Kirtland, Ohio Geol. Surv., 1838, 163.

The general verdict is that this warbler is not common as a migrant. In some regions it seems to be fairly common, and probably is sometimes so in most localities. It is a bird of the underbrush, mostly, and will not often be seen with the other warblers. It seems to be fond of feeding about and in old brush-piles in spring, and wanders along railroad tracks and fence rows during its southward migration.

The Palm Warbler reaches the state about May 22 and remains two weeks or more if conditions are favorable. It returns during the first week of September and remains about a month.

261. (673.) *DENDROICA DISCOLOR* (Vieill.). 53.
Prairie Warbler.

Synonyms: *Dendroica discolor*, *Sylvicola discolor*, *Sylvia discolor*.

Red-backed Warbler, Parti-colored Warbler, Pasture Warbler, Wildwood Warbler.

Audubon, B. Am., II, 1841, 68.

This interesting little warbler is little known by Ohio ornithologists, who regard it as a rare migrant. There are two Lorain county records of single specimens which did not remain to breed. Dr. Wheaton states that it breeds in northern Ohio but is migratory in the southern half. It should be found breeding wherever it is found in the state, but its rarity makes any records notable. Rev. Mr. Henninger regarded the specimen taken in Scioto county on October 8, 1894, as accidental. It will be found in brushy pastures and shrubby clearings, not in the woods. It is usually so confiding that a near approach is easy. Its song will not fail to arrest the attention of any one who has an ear for strange sounds. This is a warbler which all should be watchful for during the early days of May.

Migration dates are almost entirely lacking, but it is likely that records will fall within the first five days of May, for the first appearance in spring, and somewhere near the first of October for the departure in autumn from the southern counties.

262. (674.) *SEIURUS AUROCAPILLUS* (Linn.). 54.
Oven-bird.

Synonyms: *Siurus auricapillus*, *Sylvia aurocapillus*, *Motacilla aurocapillus*, *Turdus aurocapillus*.

Golden-crowned Thrush, Accentor, Golden-crowned Accentor, Golden-crowned Wag-tail Warbler, Wagtail, Land Kickup.

Kirtland, Ohio Geol. Surv., 1838, 163.

The Oven-bird is a common summer resident over the entire state, and may be abundant in suitable localities. It must have dark woods, preferably damp, but not swampy. In hilly regions it frequently nests well up on the hillside.

Its oven-shaped nest is not readily seen among the dead leaves, of which the exterior is made. The crescendo chant is one of the characteristics of some woods. The bird's dress so harmonizes with the environment that the chant may well be considered a spirit chant coming from everywhere and nowhere. The birds seldom mount high in the trees, but remain near the ground, *walking* about as any civilized bird should.

The Oven-bird reaches Oberlin near the 24th of April, sings until July 10, rarely later, and leaves us for the south during the last week of September, sometimes later.

263. (675.) SEIURUS NOVEBORACENSIS (Gmel.). 55.
Water-Thrush.

Synonyms: *Siurus nævius*, *Sylvia noveboracensis*, *Turdus noveboracensis*, *Motacilla nævia*, *M. noveboracensis*.

Water Wagtail, Water Thrush, Small-billed Water-Thrush, Bessy Kickup, River Pink, Aquatic Accentor, New York Aquatic Thrush.

Kirtland, Ohio, Geol. Surv., 1838, 163, 181 (part).

This warbler is hardly common in most sections of the state. It is sometimes almost so at Oberlin, for a few days in spring. Like the other members of this genus it is a lover of damp places, preferring those that are somewhat swampy, while with us. I have never seen it higher up in the trees than ten feet, and then only when it was greatly disturbed. Its wild ringing song is given from a low perch or from the ground. When being pursued the bird has a habit of darting off and returning behind the pursuer or silently running ahead several rods and flitting close to the ground to appear far at one side. The quest is a nerve-wearing one, but if once in a dozen times you see the bird a moment before he glides away that is reward enough. You don't wish to have all birds perch on your nose!

The Water-Thrush reaches Oberlin about the 3d of May and passes north with the warbler host about May 22. It returns during the early days of September and remains until the 1st of October.

264. (676.) *SEIURUS MOTACILLA* (Vieill.). 56.

Louisiana Water-Thrush.

Synonyms: *Siurus motacilla*, *Sylvia noveboracensis*, *Turdus noveboracensis*, *Seirus ludovicianus*, *Turdus motacilla*.

Large-billed Water-Thrush, Large-billed Accentor, Water Wagtail, Large-billed Wagtail Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 181 (part).

This is really the earliest of all the warbler group, but does not get the credit it deserves because its name is not warbler. I have found it at Oberlin the last of March. It is only locally common as a summer resident in the state; in most places it is not common, but can hardly be considered rare. In Lorain county it is pretty strictly confined to the deep stream gorges or to the hills and banks at the lake shore. Somewhere in every stream gorge a pair or more may be found during the summer. Of course the gorges must be wooded, and with a stream flowing at the bottom. This species prefers to remain on the ground, seldom perching in a tree unless disturbed about its nest or young. Its wild song echoes and reëchoes in the steep walled gorge, recalling the untamed spirit of the Red man whose hunting ground this once was.

The average dates of arrival for this species fall within the first week of April, for southern Ohio, and a week later for Lorain county. The last ones leave the state during the middle of October.

265. (677.) *GEOTHLYPIS FORMOSA* (Wils.). 58.

Kentucky Warbler.

Synonyms: *Oporornis formosa*, *Sylvia formosa*, *Myiodioctes formosa*, *Sylvicola formosa*.

Kentucky Yellow-throat.

Audubon, Orn. Biog., 1, 1831, 196.

Dr. Wheaton says of this warbler, "Rare summer resident; in particular localities only." It is now fairly common over most of the southern third of the state, and ranges nearly to the lake in the western half, and rarely to the lake in the

eastern half of the state. There are three probable records of its occurrence in Lorain county.* In the rougher parts of the state this warbler is to be found in the gorges well grown with brush and trees. It seems partial to the steep hillsides in such localities.

The first appear in southern Ohio during late April or early May, and return south late in September.

266. (678.) *GEOTHLYPIS AGILIS* (Wils.). 57.
Connecticut Warbler.

Synonyms: *Oporornis agilis*, *Sylvia agilis*, *Trichas agilis*.
Kirtland, Ohio Geol. Surv., 1838, 162, 182.

This is one of the rare warblers which pass entirely across the state. Dr. Wheaton recorded five specimens taken in the state. The unquestionable records since 1882 are hardly more. But three have been recorded for Lorain county, one of them May 24, 1902. It must be looked for on or near the ground in brushy places, but not necessarily where it is wet. The birds are timid and retiring, but may be closely approached with care. I have never heard the song to know it.

The migrations appear to occur rather late in spring, and the return in fall is during the early part of August.

267. (679.) *GEOTHLYPIS PHILADELPHIA* (Wils.). 59.
Mourning Warbler.

Synonyms: *Sylvia philadelphia*.

Philadelphia Warbler, Black-throated Ground Warbler.
Wheaton, Ohio Agri. Report, 1860, 363, 373.

While this species seems to be more numerous than the last, it is by no means common anywhere in the state. It does not remain to breed, but passes north of our border. During their migrations these birds are to be found on or near the ground, rarely mounting into the lower branches of the trees. They seem to prefer brushy tangles within

*Since the above was written a specimen has been secured at Oberlin by the writer.

the woods, and have been found only in rather damp places in Lorain county. They are usually silent while here.

The individuals recorded at Oberlin have been among the latest arrivals—between the 10th and 15th of May. They remain but a week or ten days and then pass northward, returning early in August.

268. (681d.) GEOTHYLPIS TRICHAS BRACHIDACTYLA
(Swain). 60.
Northern Yellow-throat.

Synonyms: *Geothlypis trichas*, *Sylvia trichas*, *Trichas marylandica*, *Turdus trichas*.

Yellow-throated Ground Warbler, Ground Warbler, Black-masked Ground Warbler, Black-cheeked Ground Warbler, Black-necked Yellow-throat, Briar Wren, Yellow Briar Wren, Maryland Yellow-throat.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

This little brush warbler is everywhere common, and locally abundant in Ohio. It will be found in the brushy woods, weed-grown swales, or sloughs, in second-growth slashings, or in the fringe of brush surrounding high woods. In general it prefers damp situations, but may nest almost anywhere if the conditions are suitable for a nest. No doubt there are places in the hilly south-eastern parts of the state where this bird is rare if present, because the conditions which entice him are wanting.

The Northern Yellow-throat reaches Ohio during the last week in April and is soon common even to the northern counties. It sings during its entire stay, leaving the state early in October.

269. (683.) ICTERIA VIRENS (Linn.). 61.
Yellow-breasted Chat.

Synonyms: *Icteria viridis*, *Turdus virens*, *Muscicapa viridis*.
Yellow Mockingbird.

Audubon, Orn. Biog., II, 1834, 223.

This large unwarbler-like warbler is far more common in the southern counties than at the lake shore. Apparently the gradation is a nearly uniform one from the Ohio

river to Lake Erie. It is locally abundant in the southern counties and is almost rare in the northern, except locally, where it may become fairly common. This is another thick-et loving bird, and is found in nearly the same situations as the Maryland Yellow-throat, but in the smaller growth of trees. The birds live higher up, and usually nest higher; but, like the Yellow-throats, they must have brushy conditions, at least.

The Chat reaches Oberlin about the first of May and tarries until the first week of September.

270. (684.) *WILSONIA MITRATA* (Gmel.). 62.

Hooded Warbler.

Synonyms: *Myiodioides mitratus*, *Sylvania mitrata*, *Motacilla mitrata*.

Hooded Fly-catching Warbler, Mitred Warbler, Black-headed Warbler, Selby's Warbler.

Read, *Fam. Visitor*, III, 1853, 367.

The summer distribution of this warbler is somewhat peculiar. In general it is more common southerly than northerly, but about Jefferson it is almost common. It is reported as rare during the summer near Cleveland. There is but a single record for Lorain county, and that was not a breeding bird.* It is certain that the species would have been found if it breeds in the vicinity of Oberlin. Even in the southern counties it is only locally common.

The Hooded Warbler frequents the undergrowth of the woods, but often mounts high up among the branches to sing. Its nest is in the undergrowth. In my experience the preferred nesting-place is in some rather flat woods among the spice bushes or other shrubbery which grows well under tall trees.

The migration records are somewhat uncertain, but seem to be during the first week of May and the last week of September.

*Since the above was written another specimen has been found at Oberlin.

271. (685.) *WILSONIA PUSILLA* (Wils.). 63.
Wilson Warbler.

Synonyms: *Myiodioctes pusillus*, *Sylvia wilsonii*, *Muscicapa pusilla*.

Green Black-capped Fly-catching Warbler, Green Black-capped Yellow Warbler, Wilson's Black-cap, Black-capped Yellow Warbler.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

Wilson Warbler is strictly migratory, passing completely across the state both spring and autumn. Dr. Wheaton said of it, "Not common migrant in spring; abundant in fall." I have never found it common at Oberlin in spring, and even less numerous in fall. Its numbers appear to have decreased since Dr. Wheaton's time. It may be found in the shrubbery of woods, or even well up in the trees, when migrating. I have found it in orchards not infrequently, in company with the other migrating host of warblers.

This warbler is usually rather late in putting in an appearance, but the fact that it is sometimes recorded late in April argues that it may well be placed with the group of warblers which arrive about May 1. It passes north about May 20, and returns early in August, to remain three weeks or more.

272. (686.) *WILSONIA CANADENSIS* (Linn.). 64.
Canadian Warbler.

Synonyms: *Myiodioctes canadensis*, *Sylvia pardalina*, *Sylvicola pardalina*, *Muscicapa canadensis*.

Canada Fly-catching Warbler, Canadian Fly-catching Warbler, Speckled Canada Warbler, Necklaced Warbler, Canada Flycatcher.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

The Canadian Warbler should be found as a migrant anywhere in the state, both spring and autumn. It is not as numerous as many species, but is certain to be seen during each migration if one be on the lookout for it. I have found it more frequently in the higher woods than elsewhere, but it also feeds in the shade trees and orchards. In the woods it prefers the middle stories of the trees.

At Oberlin this warbler makes its appearance about May 7, remaining until about the 20th. It returns early in August and individuals may be found as late as September 25.

273. (687.) *SETOPHAGA RUTICILLA* (Linn.). 65.
American Redstart.

Synonyms: *Muscicapa ruticilla*.

Redstart, Redstart Warbler, Redstart Flycatcher.

Kirtland, Ohio Geol. Surv., 1838, 163.

Redstart is a common summer resident everywhere in the state, and in many localities is really abundant. It is partial to woods which contain many small trees among the larger timber. I have never found it nesting in deep woods devoid of underbrush or some small growth, but it is usually numerous in small second-growth timber.

It reaches the state during the last week in April, and has passed to the lake shore by the 1st of May. None are seen in Lorain county after September 25, but a few individuals may tarry in southern Ohio until the middle of October.

Family MOTACILLIDÆ. Wagtails.

The single species which inhabits Ohio is generally found in flocks in the spring and fall months, and may linger into the winter in the middle and southern parts of the state. Its usually small numbers make it unimportant economically.

274. (697.) *ANTHUS PENNSILVANICUS* (Lath.). 27.
American Pipit.

Synonyms: *Anthus ludovicianus*, *A. spinoletta*, *Alauda pensilvanica*.

Brown Lark, Titlark, Pipit, Louisiana Pipit, American Titlark, Wagtail, Prairie Titlark, Reddish-brown Titlark, Louisiana Lark, Hudsonian Wagtail.

Kirtland, Ohio Geol. Surv., 1838, 163, 182.

The Pipit is so erratic in its movements that one is at a loss what to say about it. It is hardly common for more than a few days at a time, if a flock be regarded as an indi-

vidual. The most of my dates of first appearance fall within the first week of May, but there is one record for March 15, 1901. The last have gone north by May 20. I have but one autumn record, which is October 19, 1896.

While the Pipit is a bird of the fields it may also perch in trees, and in that particular differs from the Horned Larks, which it somewhat closely resembles in general habits and appearance. The slight wag to the tail is always a good field mark.

From the habits and haunts of these birds one would conclude that their chief food must be the larvæ of insects, with perhaps a good deal of weed seed or grain of one sort or another. They are fond of searching over newly plowed fields, where they may be seen feeding.

Family TROGLODYTIDÆ. Mockers, Thrashers, Wrens.

This family is so varied that it seems best to subdivide it into the two subfamilies.

Subfamily MIMINÆ. Mockers, Catbirds, Thrashers.

To this subfamily belong the larger birds which are nearly the size of the Robin. Three species occur in Ohio, one of them rarely, while the other two are common enough to be well known. The Catbird is the familiar slate-colored bird of the brushy tangles of the woods or garden, while the Brown Thrasher is more often seen along hedgerows where it nests. All members of this subfamily are famous singers and mockers.

275. (703.) MIMUS POLYGLOTTOS (Linn.). 7.
Mockingbird.

Synonyms: *Turdus polyglottus*.

Mocking Thrush, Mimic Thrush.

Kirtland, Ohio Geol. Surv., 1838, 163, 181.

As an Ohio bird the Mockingbird is certainly rare. The unquestioned records seem to be as follows: Cincinnati, Langdon, Dury; Waverly, Henninger; Perry, Beeman;

Morgan, Morris, Arrick, Davie; Oberlin, Jump (specimen); Columbus, Wheaton, Davie. The Cleveland records need confirmation. In Morgan county they were present all summer in 1896, and in the autumn of that year twenty birds were to be found. The same colony returned in 1897 but left during the cold May and June of that year, and have not been found since. There are a number of unconfirmed records of the Mockingbird from northern Ohio which may prove to be good records. But the likelihood of the presence of escaped cage-birds in the vicinity of cities, from which these reports come, throws some doubt upon the records.

Since the above was written Mr. C. H. Morris writes me that on January 25, 1903, in company with Mr. E. J. Arrick, he found and captured a Mockingbird near McConnellsville. Let us hope that this is an indication of an invasion of this beautiful singer and mimic.

276. (704.) GALEOSOPTES CAROLINENSIS (Linn.). 8.
Catbird.

Synonyms: *Mimus carolinensis*, *Turdus felivox*, *Mimus felivox*,
Muscicapa carolinensis.

Cat Flycatcher, Merle Catbird, Chat.

Kirtland, Ohio, Geol. Surv., 1838, 163.

Catbird is everywhere common during the summer, and abundant in many localities. It is probably too well known to make necessary the mention of its brush-loving proclivities. It is bold enough to make its summer home in the door-yard if a suitable nesting-place be furnished.

Forty-four per cent. of the Catbird's food consists of insects, and 56 per cent. vegetable matter. Of this 56 per cent. only one-third consists of fruit which might be cultivated. In most parts of Ohio it is certain that a large part of the fruit eaten is wild fruit. Hence the Catbird is really a decidedly beneficial bird. It cannot be denied that he eats some fruit on occasion, and may be punished for it. He is neither a witch nor a wizard, as many persons seem to think, but a plain everyday sort of bird, mostly concerned with his own business, wanting nothing only to be let alone.

The Catbird reaches the state shortly after April 20, rarely earlier, and soon becomes common. The bulk of the species has gone south by the 10th of September, but individuals may remain well into October.

277. (705.) *TOXOSTOMA RUFUM* (Linn.). 9.

Brown Thrasher.

Synonyms: *Harporhynchus rufus*, *Turdus rufus*, *Mimus rufus*. Brown Thrush, Thrasher, Sand Mockingbird, French Mockingbird, Ferruginous Thrush, Fox-colored Mockbird.

Kirtland, Ohio, Geol. Surv., 1838 163.

Although fairly common, the Brown Thrasher is far less numerous than its cousin, the Catbird. It is a great lover of hedgerows and overgrown line fences where narrow thickets have formed. It may also be found in brushy tangles, but not in woods proper.

Sixty-four per cent. of what the Brown Thrasher eats is animal matter, mostly injurious insects, while only 36 per cent. is vegetable. This bird also eats fruit in its season, but the bulk of its vegetable food is of no use to man. It is one of the distinctly beneficial species which sometimes does some damage.

Contrary to what we might expect, this bird is an early April arrival from the south, rarely appearing late in March. The late snow-storms do not seem to inconvenience it. Individuals may be found during the first week in October.

Subfamily TROGLODYTINÆ. Wrens.

Six species of wrens are found in Ohio. In the north the House, and in the south Carolina and Bewick are familiar about dwellings. The two Marsh Wrens have spoiled their voices by living so much in the damp of the marshes, but the other members of the group are good singers. The tireless energy of these birds makes the classical ant look to his laurels. We have nothing but commendation for the services rendered by these birds, even if they do occasionally usurp the dwellings of other birds.

278. (718.) *THRYOTHORUS LUDOVICIANUS* (Lath.). 21.
Carolina Wren.

Synonyms: *Troglodytes ludovicianus*, *Sylvia ludoviciana*.

Great Carolina Wren, Mocking Wren, Louisiana Wren, Hammock or Hummock Wren, Palmetto Wren, Large Wood Wren.

Kirtland, Ohio Geol. Surv., 1838, 168, 183.

Dr. Wheaton's statement, "Abundant in Southern, common and resident in Middle, rare in Northern Ohio," still holds good in the main. There is good evidence that its northern range is extending, and that the birds are becoming more common north than he knew them. They seem to be resident wherever they occur. We found them on East Sister Island, Lake Erie, and there are records even into Ontario.

In many places this wren is as familiar as the House Wren, building under the porch roof. It is fond of brushy tangles and bushy ravines or gorges. The borders of streams afford good cover.

The food of this wren is almost entirely animal, and the most of that insects. It is likely that in winter more vegetable waste may be eaten if other food is hard to secure, but at any time this large wren is one of the most beneficial of our birds.

279. (719.) *THRYOMANES BEWICKII* (Aud.). 22.
Bewick Wren.

Synonyms: *Thryothorus bewickii*, *T. b. var. bewickii*, *Troglodytes bewickii*.

Southern House Wren, Long-tailed House Wren, Song Wren, Long-tailed Wren.

Dury and Freeman, Journal Cin. Soc. Nat. Hist., II, 1879, 101.

While Dr. Wheaton and Dr. Langdon admitted this wren to their earlier lists they removed it from their later ones because the records upon which statements were made proved unfounded. The above reference is the first authentic record.

It appears that this wren, which was unknown as an Ohio bird in 1882, has extended its range northeastward almost

if not quite to our northern border as far east as Oberlin, where it has twice been recorded within the last five years. It is gradually but surely replacing the House Wren in the southern counties, possibly because it is the resident form while the House Wren migrates. It is common now as far east as Scioto county, and nearly as far north as Columbus.

The food of this wren does not differ materially from that of the Carolina Wren. It is distinctly beneficial in its food habits.

280. (721.) TROGLODYTES AEDON Vieill. 23.

House Wren.

Synonyms: *Troglodytes domesticus*, *Motacilla domestica*.

Eastern House Wren, Short-tailed House Wren, Wood Wren.
Read, Proc. Phil. Acad. Nat. Sci., VI, 1853, 396.

The House Wren, once a common summer resident in all parts of the state, is now being forced out by the invasion of Bewick Wren. It does not appear to be increasing in those parts of the state not yet covered by the last species, but is holding its own there. I have been disappointed in not finding more House Wrens about the houses. The woods are much more preferred in Ohio than in the central parts of Iowa. In certain parts of every town this wren may be found, but it is not present everywhere that a place offers.

The food consists almost wholly of insects that harm fruit-trees. It has lately been discovered that if a pair of House Wrens are driven from a box or other nesting-place which they have selected, and are permitted to nest in the vicinity, they will destroy the eggs of any birds which may nest in that place desired by them but denied them. One would not suppose vindictiveness to be a vice of Jenny Wren.

The House Wrens appear in southern Ohio about the middle of April, and a week later at Oberlin. They return south about October 1.

281. (722.) *OLBIORCHILUS HIEMALIS* (Vieill.). 24.
Winter Wren.

Synonyms: *Anorthura troglodytes* var. *hyemalis*, *Troglodytes europæus*, *T. hyemalis*, *T. parvulus* var. *hyemalis*, *Sylvia troglodytes*.

Bunty Wren.

Kirtland, Ohio Geol. Surv., 1838, 163.

Dr. Wheaton stated that this little wren is a common winter resident. It is now not at all common in most localities. Possibly its small size and lowly habits cause it to be overlooked. It is more numerous during the migrations, in Lorain county, than during the winter, arguing that the majority of individuals pass farther south to winter.

During the winter it haunts brush-piles, where it is able to pick up a respectable living of animal matter, and the stream gorges, probably passing the nights in the little caves in the rocks.

Individuals may be found as late as May 10, in spring. I have never found one before the 10th of October in autumn.

282. (724.) *CISTOTHORUS STELLARIS* (Licht.). 26.
Short-billed Marsh Wren.

Synonyms: *Troglodytes brevirostris*, *Troglodytes stellaris*.
Fresh Water Marsh Wren, Meadow Wren.

Read, Proc. Phil. Acad. Nat. Sci., VI, 1853, 395.

This is a rare bird in Ohio. It appears to breed in suitable localities anywhere in the state, but is too rare to be noticed by any but the ornithologist who is on the lookout for it. There are two Lorain county records, but neither of them of breeding birds.

Unlike the next species, this wren does not prefer the large marshes, but rather wet lands which have a rank growth of coarse grass. Here the birds build their mouse-like nest, lashing it to the grass stems. I have never seen the birds in brushy places, nor in the immediate vicinity of true marshes.

The food differs from that of the more arboreal wrens only in the kinds of insects eaten.

Its Ohio migrations cannot be accurately given because we have no data. It is likely that the birds reach Ohio during the first ten days of May, and depart southward again during the middle of September.

283. (725.) *TELMATODYTES PALUSTRIS* (Wils.). 25.

Long-billed Marsh Wren.

Synonyms: *Cistothorus palustris*, *Troglodytes palustris*, *Motacilla palustris*, *Certhia palustris*.

Salt-water Marsh Wren, Marsh Wren.

Kirtland, Ohio Geol. Surv., 1838, 163.

This Marsh Wren is abundant about most of our large marshes. Regions without marshes or marshy conditions will not be visited by this species. I found them literally swarming at Licking and Lewiston reservoirs, Sandusky Bay marshes and Chippewa Lake. A few pairs remain in the rapidly narrowing marshes at Lorain and Oak Point.

These birds are true swamp birds, lashing their nests to reeds and cat-tails which stand in the water. In my mind they are associated with Coot, Florida Gallinule, and Black Tern.

The food is largely insects, and probably also some other small animals inhabiting such regions.

This wren reaches Lorain county during the first five days of May, and is gone by the middle of September.

Family CERTHIIDÆ. Creepers.

284. (726.) *CERTHIA FAMILIARIS AMERICANA* (Bonap.). 20.

Brown Creeper.

Synonyms: *Certhia familiaris*, *C. f. rufa*, *C. americana*.

American Creeper, Little Brown Creeper.

Kirtland, Ohio Geol. Surv., 1838, 164.

The Brown Creeper is sometimes common during the migrations, but is less common as a winter resident over the entire state. His small size and weak voice and resemblance to the bark of trees serve to hide him from all but

the inquiring eye. In winter he prefers the deep woods, though often found in towns; but during the migrations he frequently pursues his search for insects and larvæ in the bark of our shade trees. In winter I have usually found him among the company of nuthatches, woodpeckers, and titmice.

In spring he tarries well into May, returning late in September.

Family PARIDÆ. Nuthatches and Titmice.

Subfamily SITTINÆ. Nuthatches.

The nuthatches are so different from all other birds in their manner of feeding that they attract attention at once. They much prefer to cling head downward on a perpendicular tree trunk, prying into the crevices of the bark, or "hatching" the kernel from some nut or seed. They always want to know what you are and what you propose to do about it. They are poor singers, but the voice is strong and carries far. The term "sapsucker" is wholly misapplied to these birds. They are wholly useful.

285. (727.) *SITTA CAROLINENSIS* Lath. 17.

White-breasted Nuthatch.

Synonyms: White-bellied Nuthatch, Carolina Nuthatch.
Kirtland, Ohio Geol. Surv., 1838, 164.

All must know this interesting inhabitant of the trees, for he is common all the year everywhere in the state, coming into the parks and not infrequently building his nest there or in the shade trees along the streets. He may be found everywhere that trees grow, especially in winter. He is usually the first of the winter company to make his presence known in the woods. His habit of clinging and feeding head down on the trunk of a tree attracts attention to him at once.

The food of this bird is both insects and vegetable matter. The insects are such as inhabit the bark of trees, mostly, and the vegetable matter seems to be largely the beech-

nuts and the other small forest nuts and fruits. I have seen the nuthatch descend to the ground for weed seed and other tidbits which have fallen upon the snow. He also sometimes searches about the decaying stumps and about the roots of the trees. There is nothing in the statement that he is one of the "sapsuckers" and so injures trees. He is a very useful bird at all times.

286. (728.) *SITTA CANADENSIS* Linn. 18.

Red-breasted Nuthatch.

Synonyms: Red-bellied Nuthatch, Canada Nuthatch.

Kirtland, Ohio Geol. Surv., 1838, 164.

This nuthatch is usually less common than the preceding, and is not resident anywhere in the state. It is more common as a migrant both spring and autumn, but it winters in small numbers over the entire state, more numerous in the southwestern part. It is found in nearly the same situations as the White-breasted, and frequently ranges with it. Its food seems to be much the same.

In its migrations it reaches the state early in April and is gone north by the middle of May, returning again about the middle of September. Most have gone south again a month later, a few remaining all winter.

Subfamily PARINÆ. Titmice.

Of the members of this group which live in Ohio one is southern, scarcely reaching even the middle of the state. The other two are among the most common winter birds, the Chickadee often feeding about our houses. The Tufted Titmouse not infrequently comes into town, especially during March and April, when he is calling lustily. A whistled imitation of their calls will almost invariably bring one or more within reach of your hand. They are not so much in evidence in summer because they are busy with household affairs then.

287. (731.) *BÆOLOPHUS BICOLOR* Linn. 14.

Tufted Titmouse.

Synonyms: *Lophophanes bicolor*.

Crested Titmouse, Toupet Titmouse, Peter-peter, Sugar-bird.

Kirtland, Ohio Geol. Surv., 1838, 164.

This Titmouse is common all the year over the entire state. Its loud voice and unwariness make it a familiar woodland object. It also ventures into town during the winter and early spring, but keeps mostly to the woods. In winter it forms one of the company of small birds which range through the timber.

Its food consists of both animal and vegetable matter. The animal food is largely insects and the vegetable weed seeds and small nuts. It is at all times a useful bird.

288. (735.) *PARUS ATRICAPILLUS* Linn. 15.

Chickadee.

Synonyms: Black-capped Chickadee, Eastern Chickadee, Black-capped Titmouse, Black-cap.

Kirtland, Ohio Geol. Surv., 1838, 164.

There is hardly a more familiar bird in the state than either this more northern Chickadee or the next species. It comes into the dooryard during the winter, looking for any chance crumb, or for the suet which you may have thrown out or tied to some convenient tree. It generally retires to the woods at nesting-time, and is little seen then, but a whistled imitation of the *pe te* call will usually bring an answer and the bird himself after a little. The Chickadee is one of the most inquisitive of birds, and can readily be taught to feed from one's hand. It is well worth while to take a little time to cultivate the acquaintance of the birds which are sure to visit your yard at some time during the winter, for once they find provisions put out for them they become regular visitors, and soon call other birds to the feast. A bone not too closely picked, tied to a tree or nailed to a board placed convenient to the window, will do very well. They are also fond of suet, and broken nut meats are eagerly taken.

The food of this smaller titmouse is not unlike that of the Tufted. The Chickadee is probably a greater weed-seed destroyer.

289. (736.) *PARUS CAROLINENSIS* Aud. 16.

Carolina Chickadee.

Synonyms: *Parus atricapillus* var. *carolinensis*.

Southern Chickadee, Carolina Titmouse.

Wheaton, Ohio Agri. Report, 1874, 562.

It is difficult to distinguish between the two Chickadees at first, but one soon learns to note the smaller size of the Carolina. The notes and calls are also different, being higher pitched and more rapidly given than the Chickadee of the poets, and usually of more syllables.

The distribution of this Chickadee is not clearly worked out for Ohio. It is the more common form south, but does not appear to displace the other anywhere. The evidence seems to point to a more northerly distribution in the western part of the state, where it is known as far north as Columbus and Granville, but it seems to be absent from Morgan county and east of there. We need to study the chickadees more carefully before any definite statement can be made of the distribution of this form.

Family SYLVIIDÆ. Kinglets and Gnatcatchers.

Next to the hummingbirds these are the smallest of our native birds. They are strictly arboreal, but sometimes glean from the ground. In their passage north and south the kinglets feed plentifully in our orchards and shade trees, only the Gnatcatcher remaining to nest.

Subfamily REGULINÆ. Kinglets.

290. (748.) *REGULUS SATRAPA* Licht. 13.

Golden-crowned Kinglet.

Synonyms: *Regulus cristatus*, *R. tricolor*.

Golden-crested Kinglet, American Golden-crested Kinglet,

Fiery-crowned Wren.

Kirtland, Ohio Geol. Surv., 1838, 163.

This kinglet is common as a transient, but less common as a winter resident. It is sometimes even abundant during the migrations in certain localities. The kinglets are leaf and twig gleaners, but also make sallies after flying insects. They are to be found among the evergreen trees during the winter more often than elsewhere, but also frequent well protected brushy woods to feed. Their food seems to be wholly insects.

This kinglet goes north about the middle of April and returns again about the first of October.

291. (749.) *REGULUS CALENDULA* (Linn.). 12.

Ruby-crowned Kinglet.

Synonyms: *Motacilla calendula*.

Ruby-crown, Ruby-crowned Wren, Ruby-crowned Warbler. Kirtland, Ohio Geol. Surv., 1838, 163, 183.

The Ruby-crowned Kinglet is rather more common during its migrations than the Golden-crowned, but it does not remain during the winter, nor is there any record of its breeding within the state. It is found in the same situations as the Golden-crowned, both appearing in our parks and orchards in spring and autumn. The Ruby-crowned has a louder voice than its cousin, and may be more readily found on that account. The food is the same as that of the other species.

This kinglet reaches Ohio about the middle of April and remains four weeks, returning about October 1 and passing south in about three weeks.

Subfamily POLIOPTILINÆ. Gnatcatchers.

292. (751.) *POLIPOTILA CÆRULEA* (Linn.). 11.

Blue-gray Gnatcatcher.

Synonyms: *Sylvia cærulea*, *Sylvania cærulea*, *Motacilla cærulea*.

Blue-gray Flycatcher, Little Blue-gray Flycatcher.

Kirtland, Ohio Geol. Surv., 1838, 163.

The Gnatcatcher is a fairly common summer resident in many localities, but less common in others. It is found in

brushy woods, nesting well up in the trees. It is so unwary that a near approach is easy, even if the birds do not come near to inspect you. The delicate little song carries well and must arrest the attention of the unobserving. As the name suggests, it feeds upon flying insects, but also gleanes from leaves and branches.

One might expect so small and apparently delicate a bird to tarry in the south late, but it reaches Lorain county as early as the first week in April in favorable seasons. It apparently passes south again late in September, but autumn records are not wholly satisfactory.

Family TURDIDÆ. Thrushes, Robins, Bluebirds.

The Thrushes have been placed at the top of the bird branch because of their musical ability. It does not seem likely that they will remain there long, because their structure pretty clearly points to a lower place. But wherever they may finally rest in classification they will never cease to attract the earnest attention of all those who love good bird music. Added to this æsthetic value of the thrushes, there is their undoubted usefulness economically. For the most part they are woods birds, but during the migrations most of them may be seen in the shade trees or in the back yards which have been left bushy. Robin and Bluebird are too familiar to call for any remarks of mine. They need no added encouragement to live with us, but with a little encouragement the Wood Thrush, that "Nightingale of America," may easily be induced to make its nest in the back orchard, from whence he will give you a charming serenade twice each day during the summer season.

293. (755.) *HYLOCICHLA MUSTELINA* (Gmel.). 1.
Wood Thrush.

Synonyms: *Turdus mustelinus*.

Wood Robin, Wood Nightingale, American Song Thrush,
Song Thrush.

Kirtland, Ohio Geol. Surv., 1838, 163.

The Wood Thrush is a common summer bird in all parts of the state. It announces its arrival with a burst of song, and may be heard singing well into August. Brushy woods or small second growth seem to be preferred for nesting-places. It is not so much a bird of thorny tangles as the Catbird, preferring a growth of young trees. Some make their way into the towns and villages, nesting in the orchards and berry patches in back lots. During the summer of 1902, a pair successfully reared a brood within five rods of the Chapel building on the Oberlin campus.

The food of this thrush is very largely such insects and worms as may be found on the ground among the leaves. It has not been accused of eating either fruit or garden vegetables. Its beautiful song adds to its usefulness a charm which every true bird lover cannot but wish to make a part of his summer life.

Wood Thrush comes to Ohio during the last days of April and remains well into September, but is silent during the last weeks of its stay.

294. (756.) *HYLOCICHLA FUSCESCENS* (Steph.). 2.
Wilson Thrush.

Synonyms: *Turdus fuscescens*, T. wilsonii.

Veery, Tawny Thrush, Nightingale.

Kirtland, Ohio Geol. Surv., 1838, 163.

The Veery is much less common than the Wood Thrush, but during the migrations may be fairly common. Occasionally a few remain to breed even south to our southern border. In the northern tier of counties it is regularly found all summer, but in small numbers. Its vocal powers are of an entirely different order from the Wood Thrush, being rather weird than beautiful. It lives in close company with the Wood Thrush, apparently nesting in much the same localities. The food habits do not seem to be materially different.

Wilson Thrush is usually a few days later than the Wood Thrush, in spring, and departs a little earlier.

295. (757.) *HYLOCICHLA ALICIÆ* (Baird), 3.
Gray-cheeked Thrush.

Synonyms: *Turdus swainsoni* var. *aliciæ*, *T. aliciæ*.

Alice's Thrush.

Baird, Rev. N. Am. Birds, 1864, 23.

Dr. Wheaton records this thrush as a "Common spring and fall migrant." It has been universally reported as a rare migrant. I have no doubt that closer acquaintance with it will prove it to be less rare. It is not easy to distinguish between this and the next species. I have found it only in the brushy woods in company with the Olive-backed. It appears to keep closer to the woods than the Olive-backed, feeding there on or near the ground. Its food probably consists of insects and worms largely.

Migration records are not satisfactory. Lorain county dates fall close to May 10, which is apparently near the end of the spring migration. I have no autumn dates.

296. (758a.) *HYLOCICHLA SWAINSONI* (Cab.). 4.
Olive-backed Thrush.

Synonyms: *Turdus swainsoni*.

Swainson's Thrush, Little Thrush, Swamp Robin.

Wheaton, Ohio Agri. Report, 1860 (1861), 379, hypothetical, Reprint, 5.

"Abundant migrant" characterizes this species in a few localities, as it apparently did for Columbus, at least when Dr. Wheaton was working. At most localities it is only common. This thrush is often seen in the parks and shade trees during its migration, where I have seen it feeding upon the tender shoots of trees, probably the young buds of the elms. Rev. Mr. Henninger found it eating gum berries in September. Its food must consist of insects captured on the ground or in trees indifferently. I have often seen it making sallies after flying insects, much after the manner of the flycatchers.

This thrush appears at Oberlin during the last five days of April and has gone north by May 23. It returns early in September and tarries about four weeks.

297. (759b.) *HYLOCICHLA GUTTATA PALLASII* (Cab.). 5.
Hermit Thrush.

Synonyms: *Hylocichla unalascae pallasi*, *Turdus pallasi*, *T. minor*, *T. solitarius*, *T. aonalaschkæ pallasii*.

Solitary Thrush, Rufous-tailed Thrush, Eastern Hermit Thrush, Swamp Robin, Ground Swamp Robin.

Kirtland, Ohio Geol. Surv., 1838, 163.

This thrush must be looked for early in April or late in March, and for that reason may be overlooked by many students of the migrations. It remains in the deeper woods during its stay, and is usually silent. I have heard it sing on only one occasion. Dr. Langdon reports the breeding of this species in the vicinity of Cincinnati, on the authority of Mr. Charles Dury. It appears to be the only breeding record for the state.

The food habits do not seem to differ materially from those of the other thrushes, except that it is found earlier and does not venture into our parks and gardens.

As suggested above, this thrush arrives early in April, usually departing about the time the other thrushes arrive. It returns in October and is present but a short time.

298. (761.) *MERULA MIGRATORIA* (Linn.). 6.
American Robin.

Synonyms: *Turdus migratorius*.

Robin, Robin Redbreast, Migratory Thrush, Red-breasted Thrush.

Kirtland, Ohio Geol. Surv., 1838, 163.

Robin is a common resident in the southern counties, much less common in the middle parts and rare as a resident in the northern counties in favorable situations. As a summer resident it is abundant from the middle of the state north, but less so south. While a few individuals remain all winter well north it should be regarded as a spring arrival and summer resident there. During the breeding season it is to be found everywhere except in the deep woods and swamps. During the molting season it retires to the deep woods in some numbers, but many still remain about

our lawns. It roosts at night with the blackbirds in considerable numbers, or forms roosts of its own.

The food of the Robin is varied according to the season largely. Prof. F. E. L. Beal has made a careful study of the food of this bird and it is worth while quoting extensively from his report here.

"An examination of 330 stomachs shows that over 42 per cent. of its food is animal matter, principally insects, while the remainder is made up largely of small fruits and berries. Over 19 per cent. consists of beetles, about one-third of which are useful ground beetles, taken mostly in spring and fall when other insects are scarce. Grasshoppers make up about one-tenth of the whole food, but in August comprise over 30 per cent. Caterpillars comprise about 6 per cent., while the rest of the animal food, about 7 per cent., is made up of various insects, with a few spiders, snails and angle worms. All the grasshoppers, caterpillars and bugs, with a large proportion of the beetles, are injurious, and it is safe to say that noxious insects comprise more than one-third of the Robin's food.

"Vegetable food forms nearly 58 per cent. of the stomach contents, over 47 per cent. being wild fruits, and only a little more than 4 per cent. being possibly cultivated varieties. Cultivated fruits amounting to about 25 per cent. were found in the stomachs in June and July, but only a trifle in August. Wild fruit, on the contrary, is eaten in every month, and comprises a staple food during half the year.

"The depredations of the Robin seem to be confined to the smaller and earlier fruits, and few, if any, complaints have been made against it on the score of eating apples, peaches, pears, grapes, or even late cherries."

From this it appears that the Robin is one of our most useful birds and should be rigidly protected.

The Robin is one of the first birds to greet us in spring and among the last to depart south. Dates of arrival for Oberlin fall very nearly on the first of March. The last are seen about the middle of November. A few remain all winter even on the lake shore.

299. (766.) *SIALIA SIALIS* (Linn.). 10.
Bluebird.

Synonyms: *Saxicola sialis*, *Sialia wilsonii*, *Motacilla sialis*.

Eastern Bluebird, Blue Robin, Blue Redbreast, Blue Warbler, Cottage Warbler, Blue-backed Redbreast Warbler, Common Bluebird, Wilson's Bluebird, American Bluebird.

Kirtland, Ohio Geol. Surv., 1838, 163.

Bluebird is familiar to all who ever look at birds. Previous to that disastrous cold winter—1894-5—when the Bluebirds were all but exterminated in Kentucky and Tennessee, it was decidedly common all summer. Its recovery from that calamity has been steady and rapid until it has become common again. Previous to that time there were no records for its wintering in northern Ohio, but since then it is regularly found all winter in small numbers. The survivors were a hardier race which has pushed its range farther north. Bluebirds are found everywhere except in the deep woods during the breeding season. They easily adapt themselves to the changing conditions due to the settlement of the country, and readily breed in boxes erected for their use.

They feed to a small extent upon wild fruits and their seeds, but 76 per cent. of the food is animal, mostly noxious insects. There can be no question of the usefulness of Bluebird.

Robin and Bluebird arrive very near together, and tarry equally long into November. The Bluebird is considered the "Harbinger of Spring."

ACCIDENTAL.

The species classed under this head are such as have wandered into the state from regions considerably removed which they regularly inhabit at some time of year. Their presence in the state cannot be accounted for in any other way than by supposing that some accident is responsible for their appearance in a place so far removed from their regular habitat, and therefore they cannot be expected to occur again under normal conditions.

ORDER PYGOPODES. Diving Birds.

Family ALCIDÆ. Auks, Murres, and Puffins.

The only representative of this salt-water inhabiting family is the Brünnich Murre, which was probably blown across Canada by a severe northeast storm. It is accidental in the state, and so would not figure in the economy of the state.

1. (31.) URIA LOMVIA (Linn.). —
Brünnich Murre.

Butler, reported by E. L. Moseley as occurring at Sandusky on Lake Erie, Auk, 1897, 198.

The records that have come to me of the capture of specimens of this species in Ohio are: Ashtabula 1, Lake 2, Lorain 4, Erie 3, and likely Ottawa counties, all during the last half of December, 1896. Fairport, December 18; Sandusky, December 19. The Lorain and Ashtabula records are given as late December, probably about Christmas. It is not unlikely that individuals of this large inland flight penetrated to some of the interior waters of this state, but if so, records are lacking.

A wanderer from the northeast.

ORDER TUBINARES. Tube-nosed Swimmers.

The order is represented by a single species, three individuals of which were probably blown inland by a severe southeast storm, reaching Cincinnati on the Ohio river. Being wholly accidental in the state, and unlikely to occur again except under similar conditions, the species does not figure economically.

Family PROCELLARIIDÆ. Petrels, etc.

2. (98.) *ÆSTRELATA HASITATA* (Kuhl.). —.
Black-capped Petrel.

Synonym: *Procellaria hasitata*.

Lindahl, Auk, XVI, 1899, 75.

This reference may not be earlier than the Seventh Annual Report, Ohio State Academy Sciences, 56, same author, but absence of a specific date in that publication makes the above reference take precedence.

Two specimens were taken alive on October 5, 1898, on the Ohio shore, and one on October 4, the preceding day, on the Kentucky shore. All died in captivity and found their way into the collection of the Cin. Soc. Nat. Hist. All were in a starved condition, and therefore easily captured. Dr. Lindahl says that a severe northeast storm probably drove them inland.

Accidental from the east.

ORDER STEGANOPODES. Totipalmate Birds.

Family FREGATIDÆ. Man-o'-War Bird.

But a single specimen of the single species comprising this family has been taken in the state, reference to which is given under the species.

3. (128.) *FREGATA AQUILA* Linn. —.
Man-o'-War Bird.

Synonyms: *Pelecanus aquilus*, *Tachypetes aquilus*.

Frigate, Frigate Pelican, Hurricane Bird.

Davie, Nests and Eggs of N. Am. Birds, 1898, 74.

The single specimen for Ohio, according to Oliver Davie, in the above reference, "is now in the possession of Dr. Renshaw, of Sugar Grove, Ohio, and was taken by Mr. Emmet Adcock, in Fairfield county, Ohio, in the spring of 1880."

ORDER ANSERES. Ducks, Geese, Swans.

Subfamily ANATINÆ.

4. (136.) MARECA PENELOPE (Linn.). —.
Widgeon.

Synonyms: *Anas penelope*.

European Widgeon.

Jones, *The Wilson Bulletin*, 1902, 71.

The specimen here recorded was captured on the Licking reservoir, March 29, 1902, by Mr. Peter Hayden, of Columbus. The specimen was given to Mr. Irving A. Field who mounted it for the museum of Dennison University, Granville, Ohio, who reported this and another specimen captured there April 1.

Accidental from the east.

5. (141.) QURQUEDULA CYANOPTERA (Vieill.). —.
Cinnamon Teal.

Synonyms: *Anas cyanoptera*.

Davie, *Nests and Eggs of N. Am. Birds*, 1898, 81.

"On the 4th of April, 1895, a fine male of this species was killed at the Licking county reservoir, by William Harlow." The specimen is now in Mr. Davie's private collection.

A wanderer from the west.

ORDER HERODIONES. Bitterns, Herons, Storks,
Ibises, Egrets.

SUBORDER IBIDES. Spoonbills and Ibises.

Family IBIDIDÆ. Ibises.

A single species of this family rarely wanders north to Ohio.

6. (186.) *PLEGADIS AUTUMNALIS* (Hasselq.). 193.
Glossy Ibis.

Synonyms: *Plegadis falcinellus*, *Ibis ordii*, *Ibis falcinellis*, *Ibis falcinellus* var. *ordii*, *Tringa autumnalis*.

Black Snipe, Black Curlew.

Dr. Wheaton records the only specimen of this species which has ever been taken in Ohio, as follows: "Dr. Kirtland, after quoting from the Boston Traveler (June, 28), 1850, an account of the capture of this species at Cambridge and Middleboro, Massachusetts, and Middletown, Connecticut, says: 'To the above we would add that two of these interesting birds, probably a pair, were seen two years since near Fairport, Lake county. One of them, a beautiful male, was shot by Mr. Pruden, and forwarded to us. It was duly skinned and mounted, and may now be seen alongside of a Scarlet Ibis, from the banks of the Amazon, in the second case south of the door, in the cabinet of Nat. Hist., at Cleve. Med. Col.'"

A wanderer from the south.

ORDER PALUDICOLÆ. Cranes, Rails, etc.

Family GRUIDÆ. Cranes.

7. (205.) *GRUS CANADENSIS* (Linn.). —.
Little Brown Crane.

Synonyms: *Ardea canadensis*.

Davie, Nests and Eggs of North American Birds, Fifth Edition, 1898, 121.

"I mounted a specimen of this bird which was taken in the spring of 1884, from a flock of seven or eight birds near Springfield, Ohio. It is a rare migrant in the state." This is the only state record, and must be regarded as strictly accidental. It is not given by Butler as a bird of Indiana, and is regarded as a doubtful species in northern Michigan.

A wanderer from the west.

ORDER LIMICOLÆ. Shore Birds.

Family SCOLOPACIDÆ. Snipes, Sandpipers, etc.

8. (260.) PAVONCELLA PUGNAX (Linn.). [219.]
Ruff.

Synonyms: *Machetes pugnax*, *Trigna pugnax*, *Philomacus pugnax*.

Reeve, *Combatant*, Gambetta.

Wheaton, *Bull. Nuttall Orn. Club*, II, 1877, 83.

The above citation is of a specimen obtained by Dr. Theodore Jasper, at Licking reservoir, November 10, 1872. Rev. W. L. Dawson informs me that there is another specimen in the collection of the Ohio State University bearing date of April 28, 1878, taken at Columbus.

The credit for the preservation and final identification of the first specimen belongs to Dr. Wheaton.

A wanderer from the east.

ORDER RAPTORES. Birds of Prey.

Family FALCONIDÆ. Hawks, etc.

- 9.(337b.) BUTEO BOREALIS CALURUS (Cass.). —.
Western Red-tail.

Synonyms: *Buteo calurus*.

Black Red-tail.

A specimen in the collection of the Ohio State University proves to belong to this form. It was captured November 20, 1875, by Theodore Jasper, presumably near Columbus, since it is labeled "Franklin Co." in Dr. Jasper's handwriting. It is labeled a female.

ORDER PICI. Woodpeckers.

Family PICIDÆ.

10. (395.) DRYOBATES BOREALIS (Vieill.). —.
Red-cockaded Woodpecker.

Synonyms: *Picus borealis*.

Pine-bark Woodpecker. "Sapsucker."

A specimen in the Ohio State University collection bears the following inscription: "Picus borealis. March 15, 1872. Loc. Columbus, O. It was in company with another of its own kind and 2 or 3 sapsuckers, nuthatches, etc., and shot from a high tree between the canal and Scioto river." It proves to be a typical specimen of this species.

ORDER PASSERES. Perching Birds.

Family TYRANNIDÆ. Flycatchers.

11. (443.) MUSCIVORA FORFICATA (Gmel.). —
Scissor-tailed Flycatcher.

Synonyms: Muscivora forficata, Milvulus forficatus.

"Fork-tailed Flycatcher," Swallow-tailed Flycatcher.

Davie, Nests and Eggs of North American Birds, Fifth Edition, 1898, 297.

"A male specimen of the Scissor-tailed Flycatcher was taken near Marietta, O., May 20, 1894, by Mr. Frank H. Welder, the skin of which is now in his collection."

A wanderer from the southwest.

Family ICTERIDÆ. Blackbirds, etc.

12. (497.) XANTHOCEPHALUS XANTHOCEPHALUS .
(Bonap.). [116.]
Yellow-headed Blackbird.

Synonyms: Xanthocephalus icterocephalus, Icterus xanthocephalus.

Wheaton, Ohio Agri. Report, 1874, 567: Mentioned by Coues, Birds N. W. as probable in Ohio.

There is a specimen in the collection of F. Frey, of Sandusky. A flock of six passed over Oberlin just above the treetops, October 9, 1896.

One is reported from McConnellsville, Morgan county, by Mr. E. J. Arrick.

These, with the statement of Dr. Wheaton that a pair was seen by Mr. W. R. Limpert, in the summer of 1873, near Groveport, Franklin county, exhaust the Ohio records that I have been able to find.

A wanderer from the west.

Family FRINGILLIDÆ. Sparrows, etc.

13. (553.) ZONOTRICHIA QUERULA (Nutt.). —.
Harris Sparrow.

Synonyms: *Fringilla querula*.

Hooded Crown Sparrow, Black-hood Sparrow.

Davie, Nests and Eggs of N. Am. Birds, 1898, 337.

"On the 29th of April, 1889, Mr. J. E. Gould shot a specimen of Harris Sparrow two miles north of Columbus, Ohio. Four or five others were observed feeding in a thicket in company with the White-throated Sparrow, *Z. albicollis*." The specimen was presented to Mr. Davie, and his identification corroborated by Mr. C. F. Batchelder. The skin is now in the collection of the Ohio State University. This small group must have wandered far out of their way in the northward migration.

A wanderer from the west.

Family MNIOTILTIDÆ. Wood Warblers.

14. (672a.) DENDROICA PALMARUM HYPOCHRYSEA
Ridgw. —.
Yellow Palm Warbler.

McCormick, Auk, IX, 1892, 397.

This specimen, captured on April 10 (not 16 as in the Auk, 1892), remains the only record for the state. It was taken by Mr. G. D. Wilder, at Oberlin.

A wanderer from the east.

Family PARIDÆ. Titmice, etc.

15. (729.) SITTA PUSILLA Lath. [19.]
Brown-headed Nuthatch.

Kirtland, Ohio Geol. Surv., 1838, 164, 183.

Dr. Kirtland's statement, "I once killed a specimen in the northern part of the state," remains the only instance of its occurrence within our limits.

INTRODUCED.

Of the four species which have been introduced into Ohio but two are to be found now. The English Sparrow has become not only a nuisance, but a menace to the balance of nature between the insects and those birds which feed upon insects, by crowding the native birds out in many instances. It is not at all certain that the Mongolian or Ring-necked Pheasant may not, ere long, also prove a menace to the agricultural interests by a too great increase in numbers. Happily the other two foreign species were unable to gain a foothold in our state. They might not have proved injurious if they had succeeded in becoming acclimatized, but it is never safe to make predictions. Recent legislation forbids the importation of other birds and mammals into the United States except under proper supervision. It is not likely that we shall have to learn over again the folly of precipitate action of this sort.

ORDER GALLINÆ.

Family PHASIANIDÆ.

1. PHASIANUS TORQUATUS.

Ring-necked Pheasant.

Synonyms: Mongolian Pheasant.

Successfully introduced into Allen, Ashtabula, Crawford, Erie, Hamilton, Hardin, Madison, Morgan, Scioto, and Summit counties, and probably others.

ORDER PASSERES.

Family FRINGILLIDÆ.

2. PASSER DOMESTICUS (Linn.). [unnumbered.]

English Sparrow.

Synonyms: Pyrgita domestica, Fringilla domestica.

European House Sparrow, Philip Sparrow, Parasite Gamin, Hoodlum, Tramp, The Sparrow.

Wheaton, Ohio Agri. Report, 1874, 566.

The first importation of this pest into the state directly from Europe was into Cleveland, in 1869, twenty pairs. During the same year thirty-three pairs were taken from New York to Cincinnati and Warren. Then followed importations into Marietta, 1870, Coshocton and Portsmouth, 1874, Steubenville, about 1880 or 1881, Wapakoneta, about 1882, which seems to have been the last importation. Since that time it has spread well over the state, in the more settled districts, even invading the country places and farm buildings, until the tendency to nest in the woods grows strong. About Oberlin several pairs have already invaded the trees rightfully belonging to Bluebirds and Crested Flycatchers, in the woods a mile from the village.

EXTINCT.

But two native and two introduced species have become extinct in historic times. At least three others are rapidly approaching extinction: these are Wild Turkey, Passenger Pigeon, and Swallow-tailed Kite. It was supposed that these would prove extinct, but records of occurrence within the past ten years make it necessary to retain them for the present. The causes for the disappearance of these two native birds and the great decrease of the others are not far to seek. They have been mercilessly hunted and their natural breeding places have been destroyed in the settlement of the state. Lacking the ability to change their habits with the changing conditions, it was inevitable that they should die out.

ORDER GALLINÆ.

Subfamily TETRAONINÆ.

1. (305.) *TYMPANUCHUS AMERICANUS* (Reich.). 183.
Prairie Hen.

Synonyms: *Cupidonia cupido*, *C. americanus*, *Tetrao cupido*.
Pinnated Grouse, Prairie Chicken.

The last trace I have been able to find of the presence of this bird in the state is that of Prof. E. L. Moseley, who reports a capture in 1880, near Sandusky. It is now extinct within the state.

Apparently this bird has always been confined to the northwestern prairies of the state, and can hardly have been common at any time within the history of the state as a state.

ORDER PSITTACI. Parrots.

The single species representing this order in Ohio is now extinct in the state

Family PSITTACIDÆ. Parrots and Paroquets.

2. (382.) *CONURUS CAROLINENSIS* (Linn.).
Carolina Paroquet.

Synonyms: *Psittacus carolinensis*.

Orange-headed Parrot, Carolina Parakeet, Carolina Parrot, Parakeet, Illinois Parrot.

Wilson, *Am. Orn.*, III, 1811, 89.

It is probably true that this almost extinct species was an inhabitant of the larger part of Ohio during the first decade of the 19th century and previously, reaching Lake Erie at its western end at least. In 1831 Audubon remarked upon the rapid decline in numbers. Later than that the birds were largely confined to the southwest corner of the state, occurring in small and scattered flocks as far north as Summit county up to 1853. "In July, 1862, a flock numbering from twenty-five to thirty made their appearance in the Capitol Square of Columbus," remaining a couple of hours in the elm trees in front of the residence of Wm. S. Sullivan, LL.D., who reported this occurrence to Dr. Wheaton.

Mr. Oliver Davie says: "The last record we have of this bird being taken in Ohio is October 9, 1884. A specimen was shot by Mr. A. Lee Hoskinson, near Newark, and mounted by S. G. Hamilton. . . . It is still in Mr. Hoskin-

son's possession." It is not impossible that this was an escaped cage-bird.

There can be no doubt that this belongs to the extinct species of the state.

ORDER PASSERES. Perching Birds.

Family ALAUDIDÆ. Larks.

3. (473.) *ALAUDA ARVENSIS* Linn. [unnumbered]
Skylark.

Synonym: European Skylark.

Langdon, Journal Cin. Soc. Nat. Hist., I, 1878, 111.

The first attempt to introduce this European species into the state was by a Mr. Bateham in the autumn of 1851, when a cage of them was liberated in the grove back of the Lunatic Asylum, Cincinnati. Colonel Harris stated that these shortly disappeared. Another more successful attempt seems to have been made during the seventies, since Dr. Langdon, in his list of 1878, states that they had been found breeding in the outskirts of Cincinnati. This colony must have disappeared shortly after Dr. Langdon's list was published, for nothing more was known about them when Dr. Wheaton published his catalogue in 1882. Skylarks are unknown in the state now.

Family FRINGILLIDÆ. Sparrows, etc.

4. *CARDUELIS CARDUELIS* (Linn.). —
Goldfinch.

Synonyms: *Fringilla carduelis*.

European Goldfinch, Thistlefinch.

Langdon, Journal Cin. Soc. Nat. Hist., IV, 1881, 342.

Introduced at Cincinnati during the years 1872-4. Apparently they did not thrive, since nothing has been heard from them since their introduction.

HYPOTHETICAL.

The species included under this head are mostly those whose known range should cover Ohio either during their migrations or during their regular wanderings, but which have not yet been found in the state. Two of the species are here placed because they are regarded as hypothetical forms in the United States. The Cincinnati Warbler is still represented by a single specimen, and Brewster Warbler has not yet been given the distinction of a sub-specific rank. It will probably be some time before the question of hybridism as applying to these two forms is settled. I have deemed it wise to place here some species included in Dr. Wheaton's catalogue on what appears now to be insufficient evidence. It is not enough to say that a species is or has been found; the statement must always be verified by specimens where the species is at all rare. No record should be allowed to stand unquestioned without the evidence of a specimen to prove that the species has occurred within the state.

1. (38.) *STERCORARIUS LONGICAUDUS* Vieill.
Long-tailed Jaeger.

This Jaeger may pass across the state in its migrations.

2. (40.) *RISSA TRIDACTYLA* (Linn.). 273.
Kittiwake.

Synonyms: *Larus tridactylus*.
Common Kittiwake.

Wheaton, Ohio Agri. Report, 1860, 371, 379.

There are two records for Ohio. That of three specimens reported by Mr. R. K. Winslow in Cleveland harbor, clearly before the eighties, and the report of Mr. E. W. Vickers for Mahoning county. I am unable to find evidence of the preservation of specimens of this gull. The fact that it is regarded as rare or even doubtful as a winter visitor in Michigan, and has never been found in Indiana

nor in Pennsylvania, throws doubt upon any record not accompanied by specimens.

3. (42.) *LARUS GLAUCUS* Brünn.
Glaucous Gull.

Arctic regions, south in winter to the Great Lakes and Long Island.

4. (65.) *STERNA MAXIMA* Bodd.
Royal Tern.

Tropical America and warmer parts of North America, casually northward to Massachusetts, the Great Lakes and California.

5. (71.) *STERNA PARADISEA* Brünn.
Arctic Tern.

This tern should be found passing across the state during the migrations.

6. (120a.) *PHALACROCORAX DILOPHUS FLORIDANUS*
(Aud.). 272a.
Florida Cormorant.

Synonyms: *Graculus dilophus* var. *floridanus*, *G. floridanus*,
Phalacrocorax floridanus.
Water Turkey.

Wheaton, Ohio Agri. Report, 1874, 575.

The evidence that this form nested in considerable numbers at the St. Mary's reservoir prior to 1875, is not beyond question.

7. (155.) *HISTRIONICUS HISTRIONICUS* (Linn.).
Harlequin Duck.

Synonyms: *Anas histrionicus*, *Histrionicus torquatus*.

Admitted to Dr. Wheaton's list in error. It may be found in the state.

8. (166.) *OIDEZIA PERSPICILLATA* (Linn.).
Surf Scoter.

Synonyms: *Anas perspicillata*.

It is likely to be found on Lake Erie.

9. (173.) *BRANTA BERNICLA* (Linn.). 246.
Brant.

Synonyms: *Bernicla brenta*, *Anser bernicla*, *Anas bernicla*.
Brant Goose.

Kirtland, Preliminary Report, Ohio Geol. Surv., 1838, 67.

The lack of specimens from Ohio necessitates placing this goose on the list of Hypothetical species.

10. (191.1.) *ARDETTA NEOXENA* Cory.
Cory Least Bittern.

If this be a good species it should be found in Ohio as a migrant and probably also breeding. It has been found breeding in Ontario, hence its migration route must cross Ohio.

11. (222.) *CRYMOPHILUS FULICARUS* (Linn.). 226.
Red Phalarope.

Synonyms: *Phalaropus fulicarius*, *Tringa fulicaria*.
Coot-footed Tringa, Gray Phalarope.

Wheaton, Ohio Agri. Report, 1861, 380, hypothetical.

This published record is based upon the statement of Mr. R. K. Winslow, of Cleveland, "that two or three specimens had been taken on Lake Erie." There being no other record, and no specimens preserved, it seems necessary to place the species in the Hypothetical list.

12. (392.) *CAMPEPHILUS PRINCIPALIS* (Linn.).
Ivory-billed Woodpecker.

Synonym: *Picus principalis*.

White-billed Logcock, White-billed Woodcock.

The evidence of the probable former presence of this regal woodpecker in Ohio is strong. A specimen was taken

in Franklin county, Indiana, which borders Ohio. The map in the Auk, 1891, by Hasbrouck, illustrating the present and former range of this bird in the United States, is made to cover the extreme southwest corner of Ohio. We shall probably never have positive evidence of its occurrence in Ohio.

13. (466a.) EMPIDOMAX TRAILLII ALNORUM Brewst.
Alder Flycatcher.

Jones, Wilson Bulletin, No. 20, 1898, 37.

This subspecies was elaborated after Dr. Wheaton's time. While it has not been reported by any ornithologists in the state, there can be no reasonable doubt that it migrates across regularly. No doubt a critical examination of specimens in the local collections throughout the state will reveal specimens of this form now supposed to be *traillii*.

14. (597.) GUIRACA CÆRULEA (Linn.).
Blue Grosbeak.

Reported at College Hill, Cincinnati, June 12, 1899, by Laura Gano. No specimen was secured. It seems likely that it may occasionally reach our southwestern border.

15. (601.) CYANOSPIZA CIRIS (Linn.).
Painted Bunting.

Reported from Sandusky by Prof. E. L. Moseley. No specimen was secured. This record, if authentic, would seem to be a case of escaped cage-bird. It is likely that wanderers may sometimes reach the vicinity of Cincinnati.

16. (675a.) SEIURUS NOVEBORACENSIS NOTABILIS
(Ridgw.).
Grinnell Water-Thrush.

Synonyms: *Seiurus nævius notabilis*.

Having been found at Brookville, Indiana, not far from our western border, it is entirely possible that it may be found in the western part of the state.

17. (21.) *HELMINTHOPILA LEUCOBONCHIALIS* (Brewst.).
Brewster Warbler.

Synonym: *Helminthophaga leucobonchialis*.

Jones, Wilson Bulletin, No. 42, June 15, 1903, 68.

On May 23, 1902, while out with my class for early morning study, we discovered a singing male of this interesting form. The first part of the song was clearly Blue-wing in all particulars, while the last was just as clearly Golden-wing. The students noticed the oddity of the song without having their attention especially called to it. We studied the bird in all lights and positions for half an hour, many times within fifty feet, with a pair of stereo-binoculars, clearly making out the white underparts, faintly tinted with yellow on the breast and a slight darkening of the chin feathers, the yellow crown and great yellow wing patch. On the 28th we again found the bird in the same situation, on the border of an open woods, and gave it even more attention than before. It was in full song, and seemed less wary than before. A week later it was gone. The evidence of nesting seemed so strong that I was unwilling to collect the bird, hoping to secure a breeding record and be able to study the hybrid family. The bird was probably not strictly typical *leucobonchialis*, but came near to it, as indicated by both song and plumage.

During the spring of 1903 two almost typical specimens have been secured and at least one other seems to be tarrying to nest in a woods half a mile west of Oberlin. I am hoping to add some direct testimony to the life history of this interesting variation.

18. (22.) *HELMINTHOPILA CININNATIENSIS* (Langd.).
31.

Cinninati Warbler.

Synonym. *Helminthophaga cinninatiensis*.

Langdon, Journal Cin. Soc. Nat. Hist., III, 1880, 119.

The single specimen collected by Dr. Langdon, May 1, 1880, at Madisonville, from which his description was

made, remains unique. In the absence of other specimens the theory of hybridism seems probable. If a hybrid it was probably between *H. pinus* and *G. formosa*. The formation of hybrids between *H. pinus* and some closely allied species seems not uncommon.

(371.) NYCTALA TENGMALMI RICHARDSONI (Bonap.).
Richardson Owl.

Synonyms: *Nyctale richardsoni*.

Tengmalm's Owl, Arctic American Saw-whet Owl, American Sparrow Owl.

Coues, Birds of N. W., 1874, 314.

There seems to be no question but this reference was an error.

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This bibliography includes that given by Dr. Wheaton, in a somewhat abbreviated form, and such other books, catalogues and periodicals as have appeared since 1882, which contain references to Ohio birds. It makes no pretensions to being a complete bibliography, but serves to show from what sources my information has been derived. Some references are of a decidedly general nature, others specific.

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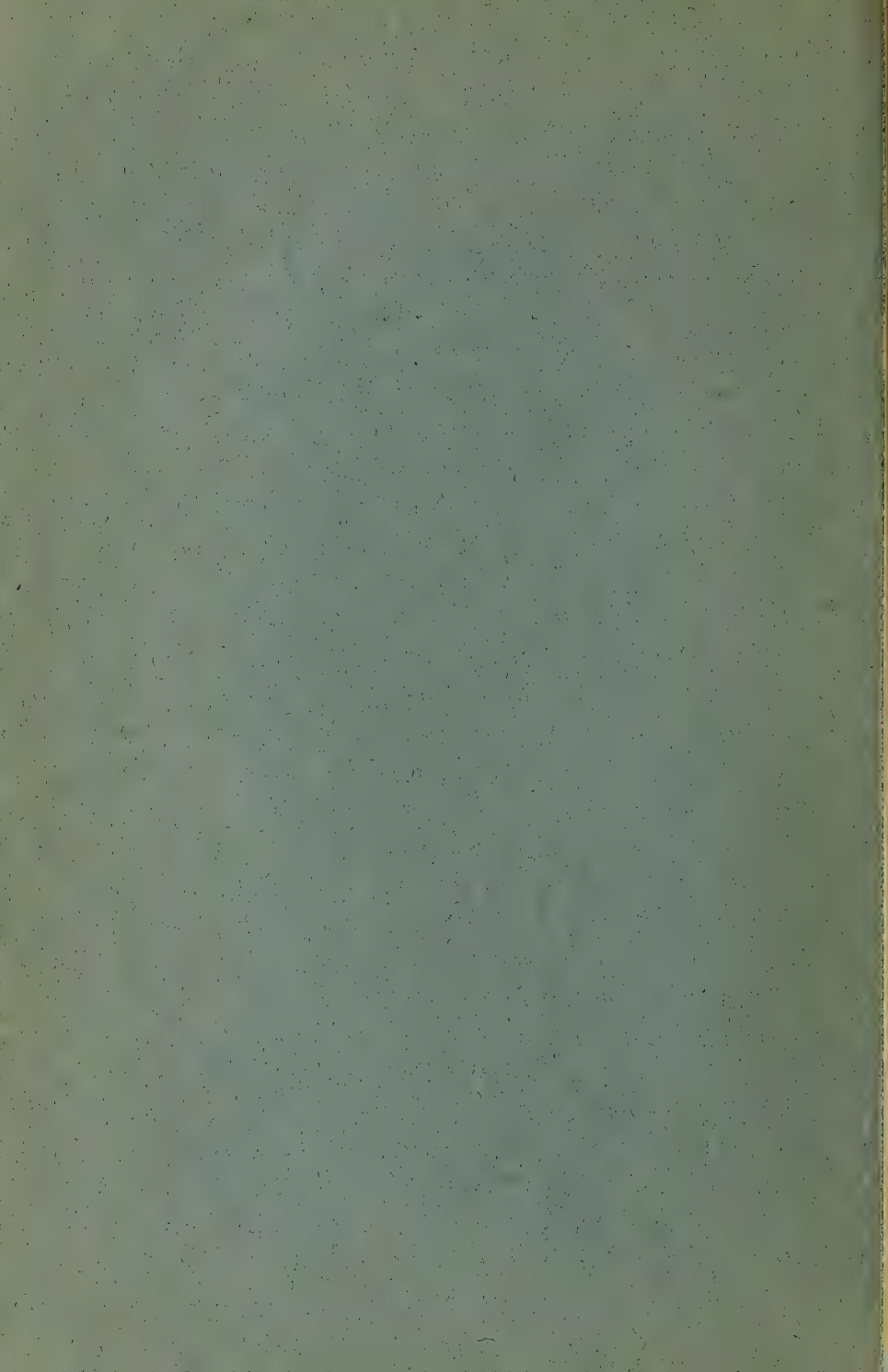
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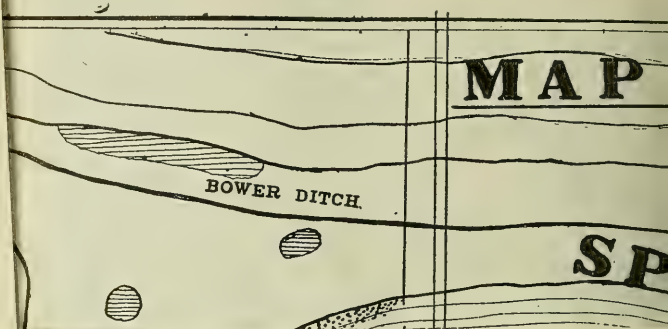
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COLUMBUS, OHIO

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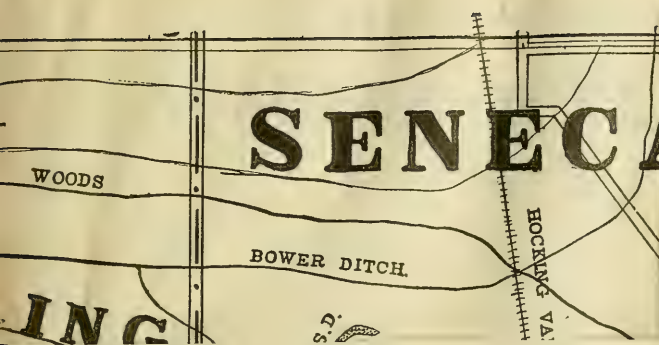


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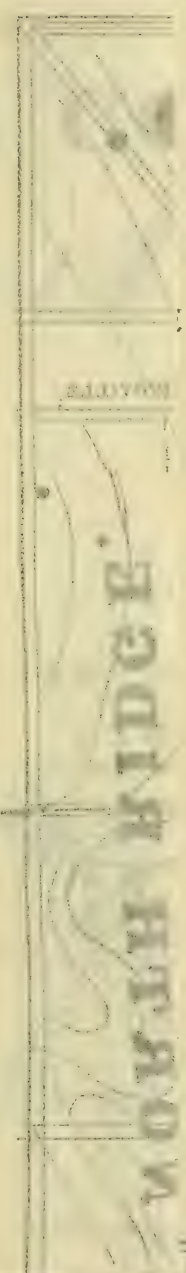


ROUTE OF WHITE
SECTION
FIRELOVE ISLAND
BANKED VIEW
ELEVATION
ISLAND DUNES
OF CRYA ISLANDS





... CORNED BEEF
 ... WOODS ...
 ... BOARDEN SHOWING ...
 ... EXPOSED ROOFS ...
 ... WOODS SHOWING ...
 ... THREE SEEDINGS ON ...



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WYANDOT COUNTY, OHIO,

BY

THOMAS A. BONSER

PUBLISHED BY THE ACADEMY OF SCIENCE WITH THE
EMERSON McMILLIN RESEARCH FUND

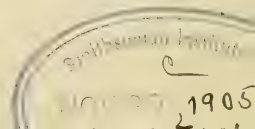
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COLUMBUS, OHIO
1903



NOTE.

The study of Big Spring Prairie, upon which this paper is based, was carried on under two grants of twenty-five dollars each from the Emerson McMillin Research Fund, and the expense of publication is met by the further aid of the same fund.

WILLIAM R. LAZENBY,

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Trustees.

INTRODUCTION.

In the Autumn of 1899, the writer began the ecological study of Big Spring Prairie, situated in Wyandot, Seneca, and Hancock counties, Ohio. This prairie is about ten miles long, and from one half to a mile wide. From its shape, it might aptly have been termed Horse-shoe Prairie. It originates just north of Carey, in fact a portion of it lies within the corporate limits of the town; thence it extends four miles in a northwesterly direction; here, making a sweeping curve, it extends three miles westward; again widely curving, it extends three miles in a southwesterly direction, ending about one-half mile north of Vanlue, Hancock county. About two and one half miles of prairie lie in Wyandot county, about the same extent in Seneca county, and five miles in Hancock county. The widest portion occurs in Seneca county, where it curves to the westward, the next widest in Hancock county, where it curves to the southwest.

The term prairie has been applied to the more or less grassy plains of the treeless regions both east and west of the Mississippi River. The eastern prairies differ in many particulars besides size, from those in the extreme west near the foot of the Rockies. Between these limits, we may find all gradations in specific characteristics. The typical eastern prairies are properly natural meadows; some, in fact, border on the semi-marsh type. This belt comprises the region from the eastern prairie limit to Missouri and Iowa. West of this there is a gradual gradation through the steppe type to the semi-desert near the Rockies.

The most striking differences between the eastern and western prairies are the climatic factors of rainfall and general humidity of the atmosphere.

The climatic factors of irregular and scanty rainfall and the general low humidity of the atmosphere are potent causes of the western type of prairie. These factors in combination with the occurrence of frequent prairie fires are sufficient to account for the absence of trees upon this type of prairie.

The origin, development, and future of the eastern type of prairie must be considered apart from the western type, as each possesses its own peculiar factors and specific characteristics. Prairies may be studied by a comparative survey of the likenesses and differences of the various types of prairie areas, and the causes which led to them. Again we may study each type comparatively with the topographic features and vegetative characteristics immediately surrounding it. This latter survey should be conducted along the border line of prairie and forest, where the struggle can be said to be fairly on, and where the effects and results of this rather uneven struggle can be most advantageously observed. A life-time is frequently long enough to observe the forest encroachment upon the eastern prairie, ages might be required to note the same degree of encroachment upon the western type of prairie.

Many theories have been advanced to account for the absence of trees on prairies; as the prairie fire theory; the fine soil theory; the ulmic acid theory; etc. Lesquereux states that prairies are formed from old lakes, or bays extending from them with the marsh as the intermediate formation, and he furthermore asserts in regards to these: "Trees never invade them, never grow upon them, even when drained." This latter statement may need some modification, as observation does not bear out the assertion "even when drained."

In the West, the prairie is the natural formation, the presence of the forest is especially to be explained.

In the East, the forest formation is the natural one, the presence of the prairie is to be explained. The

eastern prairie is only an intermediate formation between the marsh and the forest formation. It is simply a question of time. The observed facts corroborate this.

As it is difficult adequately to define tree, but much easier to define deciduous tree, still easier to define Cottonwood tree, and easiest to define *Populus grandidentata*; so it is difficult to announce principles, or elaborate a statement of facts which shall fully apply to all prairies in all conceivable localities, and under their various natural conditions, but easier to apply the same to the eastern prairie, still easier to the Ohio prairie, and easiest to apply certain well-defined principles, and give a statement of observed facts in regard to Big Spring Prairie. The last named task shall be ours chiefly in the following article. In accordance with the above, our investigations have been conducted along the following lines.

- (1) Geological formations surrounding prairie, and the characteristic vegetation of same.
- (2) Past condition of prairie, especially since 1832, in which year the Big Spring Indian Reservation was thrown open to settlement.
- (3) The drainage of prairie, past and present, and its effect upon general level of same and also upon the character of the vegetation.
- (4) The lagging behind of effects, as shown by the observed facts that plants cling for a time to a locality after the conditions have changed, in this instance from the hydrophytic to the mesophytic.
- (5) The nature of the soil in the various portions and the characteristic vegetation of same.
- (6) Tree introduction or encroachment upon prairie, the order and cause.
- (7) The prairie under cultivation.

The writer wishes to extend his thanks to Dr. H. C. Cowles, of the University of Chicago, under whose direction the investigation of this area was conducted: and also to Prof. W. A. Kellerman, Ph. D., of the Ohio State University, for some of the photographs, and for his personal visits to the area and his kind assistance in various ways. The writer is also under obligation to Mr. W. C. Johnson, Mr. Peter Brayton, and Mr. H. B. Phelps for aid rendered or information furnished.

The principal factors which must be considered in prosecuting the lines of investigation indicated naturally divide themselves into Climatic, Physiographic, Historical, and Ecological.

CLIMATIC CONDITIONS.

Big Spring Prairie is crossed at two points by the forty-first parallel, which forms the boundary line between Wyandot and Seneca counties. By reference to Map 1, it will be seen that almost equal parts of this prairie lie on either side of this line. It is about forty miles south from Lake Erie and about twenty miles north from the Ohio River and Lake Erie divide. The extremes of temperature are slightly greater here than directly along the lake shore. This, in part, may account for some of the differences in vegetation of the Big Spring Prairie and the Castalia Prairie near Lake Erie. In the Spring, the vegetation which has begun active growth during a few premature warm days, is more likely to be injured by frost than the more tardy vegetative growth of the lake region. In the Autumn, frosts occur earlier than in the lake region. Furthermore, on the low lying prairie with its moist black soil, frosts occur later in Spring and earlier in Autumn than on the ridges around it.

1. PHYSIOGRAPHIC.—GEOLOGICAL FORMATIONS SURROUNDING PRAIRIE AND CHARACTERISTIC VEGETATION OF SAME.

The Niagara Limestone is the native rock which underlies the western part of Wyandot and Seneca counties and the eastern part of Hancock county. The surface of these counties is quite level, moderate hills occurring only along the larger natural water courses. As there are no important natural water courses in the vicinity of the Prairie, the country is a rather level plain with the exception of an interesting and remarkable outcrop of Niagara Limestone. This

outcrop occurs in the form of two ridges, one is designated "North Ridge," the other "West Ridge." Each is about five miles long, but the West Ridge is the longer of the two, and considerably broader than North Ridge. North Ridge originates about one-half mile north of Carey and extends northward for nearly five miles, where it almost imperceptibly merges into the general level of the country to the north of it. The greater portion of the steepest slope is toward the Big Spring Prairie on the west. This ridge is traversed by several gently sloping drainage valleys, which may have been preglacial gulleys, now filled with drift. For the depth to the underlying rock is considerably greater here than on the median plains which also occur on portions of both ridges.

The West Ridge originates a short distance west of the corporation line of Carey, Ohio, and extends over five miles in a northwesterly direction. The Carey and Findlay pike is situated either on the crest-line of the ridge, or near it. From an inspection of Map 1, it will be seen that the crest extends first northwestward, then turns sharply to the north. The steepest slope is toward the south and west, the outcrop being quite conspicuous at certain localities. To the northeast of the crest, the land slopes quite gradually and forms a rather level plain until within a short distance from the prairie, where it forms a short but decided slope to it. This ridge is also traversed, by those broad gently sloping drainage valleys, which are especially noted for their fertility.

The characteristic Niagara fossils have been found chiefly in the North Ridge. As there are no extensive perpendicular sections of the bedding, the dip of the strata can be judged only from the perpendicular exposures in the quarries on the slopes of the ridges. It is found that the dip is quite uniformly toward the low ground nearest to the quarry. The dip in the various

quarries varies from a gentle dip of 5° to as high as 18° . The ridges are perforated with numerous sink-holes and subterranean water channels, from one of which the Carey Water Works obtains its supply for the town.

The dip of the strata and the subterranean water supply have considerable bearing upon past and present conditions of prairie, as will be explained later. In the Ohio Geological report the following theory to account for those ridges occurs: "It would seem as if the conditions of the ocean's bed in which the Niagara was formed were not uniform. While regular strata were being deposited in a wide area, including portions of Seneca and Hancock Counties, without disturbance or contortions, a concretionary and crystallizing force sprang up into operation in the northwest corner of Wyandot County which in working from below, caused the even beds of deposition to swell upward over the growing mass or masses. In some cases it aided in the preservation of fossil remains. In others it hastened their absorption into the mass of rock. This is a peculiarity of the rock formation not confined to the Niagara, but is displayed conspicuously in the water-lime above, and it has been seen in the corniferous. When the lapse of time brings such hardened masses into contact with the erosions of ice and water, they cause the prominent features of the landscape by the removal of the more destructible parts about them. Such may be the explanation of the remarkable ridges about Carey, the even friable beds seen in the quarries about their flanks having once been continuous over their summits, but unable to resist the forces of the glacial epoch were denuded down to the more enduring rock."

Thus the summits of the ridges, which are comparatively narrow for the greater part of their extent consist of a very hard Niagara Limestone, while there is a gradual transition in hardness along the sides to the rather friable strata along or near the bases.

Along the summits and edges of the ridges, the soil, varying from dark red clay to lighter shades, is exceedingly thin, the fields being covered with angular stones.

In the shallow natural drainage courses, the soil is a rich loam, as it is also on the flat median plain of West Ridge. Along the base the soil is frequently quite sandy.

Whereas the greatest heights of both North and West Ridge are about one hundred and fifty feet each, and the median plains of same about thirty to fifty feet higher than prairie, the country to the north and west of the prairie is as a rule, only about three to six feet higher than the level along edge of prairie. Even this elevation is a gradual slope reaching this height at a distance of forty to eighty rods from the edge of prairie. Although this slope is so very gradual, only in a few localities is there a gradual transition from forest to prairie. For the greater portion of its extent, the line of demarkation between forest and prairie is quite distinct. Bordering upon the southwestern portion of the prairie, there is a low wet woods in which there is no perceptible difference in level between it and the adjoining prairie.

CHARACTERISTIC VEGETATION OF THE RIDGES.

For the sake of more clearly indicating the nature of the various plant societies in a more or less limited area, it will be found expedient to employ five classes of plant societies instead of the three given by Warming. The classes under this scheme would be :

- (1) Xerophytic area.
- (2) Xero-mesophytic area.
- (3) Mesophytic area.
- (4) Hydromesophytic area.
- (5) Hydrophytic area.

The first, third, and fifth conform to Warming's classes.

A xero-mesophytic area is one in which there is an approximately even mixture of the two classes from which the name is derived. The same applies to the term Hydromesophytic. This enables us to more clearly define the peculiar characteristics of limited areas, which would otherwise be impossible.

Furthermore these terms can be employed absolutely or relatively. Absolutely considered there are no extensive xerophytic plant societies in Ohio, as only the plants occurring on more or less perpendicular rock walls; on edges of cliffs, on the lower and middle beaches of Lake Erie; on the nearly perpendicular surfaces of freshly eroded river banks can be classed as such. Even in these cases the term applies rather to the hard condition of life and to the difficulty of gaining or maintaining a foothold than to the idea of drought-enduring as commonly understood. Relatively we can designate that society of any given region, which occurs under the most unfavorable conditions, relatively xerophytic, and those in the wettest, hydrophytic, and the gradations between them as before indicated. As the latter view is apt to lead to confusion, we shall confine ourselves to the former limitations, and accordingly consider the Xero-mesophytic as the extreme of plant society in the area under consideration. And even under this heading, we can bring only the summits of the ridges, the exposed slopes, and the evident outcrops of the Niagara limestone.

Both ridges were formerly densely wooded, but at present there are only a considerable number of small areas which can be termed woodlands, and even from these, the largest and most desirable timber trees have been removed.

Although the ridges as a whole exhibit a characteristic forest formation, yet this forest formation can be divided into two distinct types occurring respectively on:

(1) The summits, the exposed slopes, and the outcrops.

(2) The level median plane, and the broad shallow drainage valleys.

The differences to be considered are two-fold.

(1) Presence of species in one area not found in the other.

(2) Relative abundance of the same species in the two areas.

The type of plant society taken as a whole would be designated as White-oak, Black-oak, Hickory Forest, a term applied by Dr. H. C. Cowles, of the University of Chicago, to a similar type of forest formation at Glencoe, Illinois. At Glencoe, Illinois, this type occurs on hills of extensive drift formation, and in this region the same type in a pronounced form occurs on an outcrop or upheaval of Niagara Limestone, both representing the Xero-mesophytic form of plant society.

The soil on the summit of the ridges and along the steepest hillsides is quite shallow, consisting largely of red clay, although various other shades of clay also occur. The underlying rock seems to weather into a slightly sandy clay soil. Numerous sink holes, now filled up, formerly occurred on these ridges. These enabled the surface water to disappear readily, and retarded the progress of the plant societies upon it, thus partially accounting for the Xero-mesophytic forest type instead of the mesophytic type which sometimes occurs upon such areas as pointed out by Dr. H. C. Cowles in his "Plant Societies of Chicago and Vicinity." The history of the plant life on this area in the past most probably conformed in its main features to the account of the "Upland Series of Plant Societies" in the work referred to, but the type of forest had not as yet attained the possible mesophytic type.

In treating of the plant societies of any region, it is not necessary or even expedient to enumerate all the plants occurring in them. The rare or accidental ones are sometimes of interest only as they may be remnants of some past society or prophecies of some future one, generally difficult of interpretation. The common plants which give character to the landscape are the ones of most interest as they have proven their fitness of survival by their successful struggle with their rivals.

The divisions under which the plants of these ridges can be divided are the Woodland Societies, The Roadside Societies, the Cultivated Field Societies, and the Pasture-land Societies, the last two constituting the troublesome weeds. The Woodland societies of the summits of ridges, steep slopes, and outcrops shall be considered separately from those of the median plane and drainage valleys, while in regard to the remaining societies, it is not necessary to thus subdivide them.

The plants of the woodland areas are conveniently arranged under the horizontal strata of trees, shrubs, and herbs. The forests on the summits of the ridges, the steepest slopes, and the outcrops of the Niagara limestone are xeromesophytic and of the White-oak, Black-oak, Hickory type of forest.

Considerably over one-half of the trees are species of *Quercus* (Oak), less than one-fourth are *Hicoria* (Hickories), the remainder are a variable mixture of *Cornus* (Dogwood), *Cercis* (Redbud), *Sassafras* (Sassafras), *Acer* (Maple), *Crataegus* (Hawthorn), *Juglans* (Walnut) *Celtis* (Hackberry), and *Ostrya* (Ironwood). Of the latter the dogwood and redbud are perhaps the more abundant, the walnut the least abundant.

The most characteristic tree is *Quercus alba* L. (White oak). The next most common ones of the oaks are *Quercus rubra* L. (Red oak) and *Quercus velutina* Lam. (Black oak). Besides these, the following occur: *Quercus minor* (Marsh), Sarg. (Post or iron oak),

Quercus imbricaria Michx (Shingle oak), and *Quercus acuminata*, (Michx) Sarg. (Chestnut or yellow oak), doubtless also a number of hybrids.

The second most characteristic tree is *Hicoria ovata* (Mill) Britton (Shell-bark Hickory), other common species are *Hicoria alba* (L.) Britton (White-heart hickory) and *Hicoria glabra* (Mill) Britton (Pignut hickory).

The following species constitute the remaining minority of individuals:

Cornus florida (L.) (Flowering dogwood), *Celtis occidentalis* (L.) (Hackberry), *Prunus pennsylvanica* L. f. (Wild red cherry), *Prunus serotina* (Ehrh) (Wild Black Cherry), *Cercis canadensis* L. (Redbud), *Sassafras sassafras* (L) Karst. (Sassafras), *Crataegus* (various species), *Acer saccharum* Marsh (Sugar or Rock Maple), *Juglans cinerea* (L) Britton (Butternut), and *Juglans nigra* L. (Black Walnut).

The infrequent *Acer* and *Juglans* are prophesies of the future mesophytic forest, which, in a state of nature, was gradually developing.

In the drainage valleys and on the median plane, the above species of oaks and hickories are less abundant, and a number of other species, which are characteristic of the strictly mesophytic forest are fairly common; as, *Ulmus Americana* L. (American elm); *Acer saccharinum*, L. (Soft Maple); *Fagus Americana* (Sweet Beech); *Tilia Americana*, L. (Basswood); *Quercus macrocarpa* Mx. (Burr-oak); *Ulmus fulva*, Thomas (Slippery Elm); *Quercus plantanoides* (Lam) Sudw. (Swamp White oak); *Quercus palustris* Du Roi (Pin oak); *Hicoria minima* (Marsh) Britt. (Bitternut); *Fraxinus Americana* L. (White Ash); *Fraxinus quadrangulata* Michx. (Blue Ash); and *Fraxinus lan- ceolata*, Borck. (Green Ash).

On a slight elevation just east of the Johnson Celery Farm, there occurs a clump of trees consisting of

eleven White Oaks, four Red or Black Oaks, two Shingle Oaks, three Hickories, and a large Elm, the last was situated in a slight depression, and is over two feet in diameter.

The principle shrubs of the xero-mesophytic area are *Corylus Americana*, Walt. (Wild Hazel-nut); *Rhus aromatica*, Ait (Fragrant Sumac); *Crataegus*, (several species); and *Rhus glabra* L. (Upland or scarlet sumac); while the following are quite common: *Hamamelis virginiana* L. (Witch hazel); *Rhus radicans* L. (Poison Ivy); *Viburnum prunifolium* L. (Black haw); *Viburnum pubescens* (Ait) Pursh. (Downy leaved arrow-wood); *Rubus villosus* ait. (High-bush blackberry); *Rubus occidentalis* L. (Black raspberry); *Ribes Cynobasti* L. (Wild Goose berry); *Rubus Canadensis* L. (Dewberry); *Vitis* sp? *Ptelea trifoliata* L. (Shrubby tree-foil); *Viburnum acerifolium* L. (Maple-leaved arrow-wood); *Celastrus scandens*, L. (Climbing Bittersweet); *Smilax*, several species; *Parthenocissus quinquefolia* (L.) Planch (Virginia Creeper); and *Enonymus atropurpureus*, Jacq. (Wahoo, or burning bush). Three of the above species *Rhus aromatica*, *Ptelea trifoliata*, and *Crataegus* were found growing, in the Summer of 1902, on a sand dune along the shore of Lake Michigan, thus proving the xerophytic capabilities of these species. Frequently by the lagging behind of effects, xerophytic plants will cling to an area for a considerable time even after the conditions have changed to the xero-mesophytic or to the mesophytic.

On the median plane and the drainage valleys, most of the above species also occur, but not so commonly; while *Benzoin benzoin* (L.) Coult. (Spicebush), *Cornus*, several species; *Rosa* sp?; and *Xanthoxylum Americanum* Mill. (Prickly Ash) are quite abundant.

The common or characteristic herbaceous plants of the xero-mesophytic area are *Antennaria plantaginifolia* (L) Rich. (Plantain-leaf Everlasting), which fre-

quently carpets large areas; *Euphorbia corallata*, L. (Flowering spurge); *Syndesmon thalictroides* (L.) Hoffinsg. (Rue Anemone); *Lithospermum canescens*, (Mx.) Lehm. (Hoary Puccoon); *Desmodium*, several species; *Hedeoma pulegioides* (L.) Pers. (American pennyroyal); *Heliopsis scabra*; (L.) B. S. P. (Rough Ox-eye); *Aster laevis* L. (Smooth Aster); *Aster undulatus* L. (Wavy-leaf Aster); *Aster ericoides* L. (White-heath Aster); *Solidago*, several species. In the mesophytic woodlands occur the usual early geophilous Spring flowers in abundance, while in the Autumn the following flourish: *Eupatorium ageratoides* L. (White snake-root); *Adicea pumila* L. (Raf. Richweed or clearweed); *Impatiens biflora*, Walt. (Spotted touch-me-not); *Lobelia syphilitica* L. (Blue lobelia); *Aster Novae-Angliae* L. (New England Aster); *Sanicula Marylandica* L. (Black snake root); *Urticastrum divaricatum* (L.) Kuntze (Wood Nettle), etc. One specimen of *Aralia racemosa* L. (American Spikenard) was found in one of the wettest woods, which occurs on the median plane.

All gradations between the xero-mesophytic and the mesophytic societies occur on different portions of the Ridges according to the direction and steepness of the slope, and the depth and character of soil.

ROADSIDE SOCIETY.

Along the roadsides and fence-rows, especially old worm-fences, some of the plants, originally occurring on the area, survive and flourish, silent witnesses of the character of former conditions and plant societies. More frequently they offer ready footing to new arrivals, prophecies of future societies. As a rule the conditions of life of roadside plants are much more adverse than those of fence-rows, and in consequence they must possess greater power of surviving in spite of hard

usage. On account of the more abundant opportunities for artificial or accidental seed dissemination along highways, these latter societies possess a greater variety of plant life than fence-rows away from highways. The most successful roadside plants are those, which, when broken or cut off, have the power of sprouting up from the stub or root. These sprouts are generally quite prolific in seed production. It is also of advantage for these plants to possess a perennial underground rootstock as many of them do. The inequalities in the level of a cross-section of the average country pike or road furnish conditions for extremely varied sub-divisions in Roadside societies.

The traveled roadbed is extremely xerophytic, the ditch or depression commonly occurring may support a hydrophytic society, while the remainder of cross-section may offer narrow beds of xero-mesophytic, and mesophytic, and hydro-mesophytic. Thus all forms of plant societies may exist in duplicate on each side of a road not over fifty to sixty feet in width. On account of the frequent rock outcrops, the roadways of the Ridges are more evenly xerophytic or xero-mesophytic than is commonly the rule; but in the drainage valleys and on the median plane the ordinary type roadway with its varied plant societies occur. The most characteristic roadside shrubs of the Ridges are *Rhus aromatica*, *Rhus toxicodendron*, and *Celastrus scandens*. Other quite common species are *Rhus glabra*, *Rubus occidentalis*, *Rubus villosus*, *Rubus Canadensis*, *Crataegus*, *Prunus*, *Smilax*, and *Vitis*.

The most characteristic herbaceous plants are *Aster multiflorus* Ait. (Dense-flowered Aster); *Asclepias tuberosa* L. (Butterfly-weed, Pleurisy root); and *Penstemon hirsutus* (L.) Willd. (Hairy Beard-tongue).

In this locality, the writer has found *Aster multiflorus* growing only on the Ridges, while at Chicago, Ill., it occurs on level sandy commons or even along

side-walks in the vicinity of the University of Chicago. As another instance of this difference of habit, may be mentioned *Celtis occidentalis* which, in Wyandot County, Ohio, occurs chiefly on ridges or bluffs, while in Illinois it is found only on the flood-plains of streams, as on the flood-plain of the Des Plaines at Riverside. A slight decrease in atmospheric humidity between two places is often sufficient to limit to very narrow boundaries the habitat of certain species; which in the more favorable localities have a wider range.

Other common herbaceous plants of the Ridge roadsides are *Melilotus alba* Desv. (White Melilot); *Plantago lanceolata* L. (Ribgrass); *Poa compressa* L. (Wire-grass); *Euphorbia* (several species); *Lithospermum arvense* L. (Corn Gromwell, Wheat-thief); *Triosteum perfoliatum* L. (Horse-Gentian); *Solidago* (various species); *Aster* (various species); *Achillea millefolium* L. (Yarrow); *Bidens* and *Carduus* (several species).

Polygala senega L. (Seneca Snakeroot) is rarely found on the ridges, and is one of the witnesses of former plant societies.

The most characteristic weed of wheat-fields is *Lithospermum arvense* (Corn Gromwell. Wheat thief), while *Ambrosia* (Ragweed), *Amarantus* (Pigweed) and *Chenopodium* (Lambs-quarters) are also quite common.

The region adjoining the prairie on the north and west was covered with a typical mesophytic forest formation of the Maple, Basswood, Beech type, with its characteristic shrubs and herbs.

2. PAST CONDITION OF THE PRAIRIE-HISTORICAL FACTOR.

On Sept. 17, 1818, a treaty was agreed upon between the U. S. Government and the Wyandot Indians. One of the articles of this treaty reads as follows: "That there shall be reserved for the use of

the Wyandots residing near Solomon's Town and on Blanchard's Fork in addition to the reservation before made, sixteen thousand acres of land to be laid off in a square form on the head of Blanchard's Fork, the center of which shall be the Big Spring on the trace leading from Upper Sandusky to Fort Findlay." This reservation is indicated by a dotted boundary line on Map I. This section was granted to the Indians because such a large portion of it was unfit for agricultural purposes; while, at the same time, it formed an excellent hunting ground for them on account of the abundance of game of various kinds. Even after the reservation was thrown open to settlement deer, beaver, otter, mink and various species of water fowl were quite common. From the wording of the article granting the Big Spring Indian Reservation to the Wyandots, one would be justified in inferring that the Big Spring was at the head of Blanchard's Fork in 1818. If this is true, there must have been a natural drainage for this section in the earlier years of the past century, and as there was no well-defined outlet when the reservation was thrown open to settlement, the outlet or Blanchard's Fork must have become so clogged up that nearly all traces of the original stream became obliterated. In a history of Seneca County the following occurs: "Big Spring was once a very powerful one, and formed a small lake. Clearing of land decreased its importance." The reservation was ceded to the U. S. in 1832 Jan. 19th, and was thrown open to settlement in 1833. Big Spring township, Seneca County, was formed March 6, 1833. The town of Springville was laid out in 1834, by which time, most of the ridge land was occupied by settlers. During this year there occurred in this section, a very destructive late Spring frost.

In 1837 the crops were greatly injured by drought. Even the marsh was well dried off for that day. The

Hocking Valley R. R. was built across a portion of prairie in 1877-78. After this, the serious prairie fires, burning even the soil, became prevalent.

The first dwelling house was built on the actual prairie in the summer of 1901. At present there are several dwelling houses upon this area.

In an interview, Mr. Peter Brayton, a pioneer of Springville, whose recollections date back to 1833, when Big Spring Indian Reservation was thrown open to settlement, stated that, in his boyhood, the prairie, which was then known as the Big Prairie in distinction from a small prairie of several hundred acres about one and a half miles east, was covered with water for the greater portion of the year. In Winter and Spring there was a continuous sheet of water from Carey to Vanlue, a distance of about ten miles. This sheet varied considerably in width and depth. Except in wet years, most of the marsh would dry off considerably in late Summer and Autumn.

A short distance north of the new road just south of Springville, there was still a permanent lake, which contained from two to four feet of water even in dry seasons. It was known as The Lake, although it was only about two miles long and twenty to fifty feet wide. Beyond this space of clear water, there was a shallower portion in which cattails, reeds, and bulrushes grew. The body of water was the last remnant of a rapidly dying lake.

The common testimony of several pioneers of this region is, that during wet Springs, canoe trips could be taken from near the cemetery just north of Carey to Springville, and that during the winter the boys would skate over this same route.

Judging from present conditions of level, the above statements scarcely seem possible, as the Divide at present occurs along new road No. 1 Map I; and this divide, according to the surveyor's measurement is about eight

feet higher than the level of prairie just north of Carey, and about ten to twelve feet higher than the lower end of old lake. Consequently, if the water was deep enough for canoeing upon the divide, and if the general level and slope were then as now, the depth of water just north of Carey must have been about eight feet and at the lower end of old lake about ten feet. But this is impossible, as it would have flooded the present site of Carey, and would have been drained into Spring Run.

Either the statements are false; or the divide has been built up considerably within the last seventy years and the general level of prairie just north of Carey and of lower end of lake are considerably lower than formerly. These last two phases will be further discussed under Drainage of Prairie, past and present and its effect upon general level of same.

It was impossible to get any reliable scientific data in regard to flora of prairie in the earlier part of the nineteenth century; but, according to statements of the pioneers, cattails, reeds, bulrushes, poison sumach (popularly called "poison shumake"), boneset, wild sun-flowers, and sedges were more abundant; while willows occurred only along the border of prairie or marsh and on a few isolated spots which were slightly higher than the general level. The wild rose occurred less frequently than at present; and the elderberry, which became so common in late years did not occur at all upon the prairie until artificial drainage was put into operation. Before this, it was one of the common plants on certain portions of the ridges.

Large areas of sedges, known as marsh grass by the old settlers, were mown for the hay. As no areas of any size were available for this purpose in late years, the almost pure sedge societies have been supplanted by other more-varied plant societies.

Although the Big Spring Prairie was in reality a marsh, perhaps similar to the Skokie Marsh in northern

Illinois, the sod, consisting of tangled sedges and grasses of the preceding year, and of the growing sedges and grasses, offered such a firm support that the marsh could be safely crossed by horses without the danger of miring, but at each step of the horses feet the ground would quiver for many rods in either direction. After the sedges and grasses were mown for hay by the settlers they would set fire to the dried sedges and grasses in the Autumn, in order that the areas might be more suitable for mowing the next year. This led to a curious but natural result. Whereas before these prairie fires cattle and horses could graze over this area without miring; after a repetition of these Autumn fires, the burned areas became so soft and treacherous, that cattle and horses frequently mired in them.

Naturally the burning of the dead sedges and grasses prevented the formation of the dense carpet of tangled vegetable remains, and thus the upper crust being broken in places, the area became a true morass. This condition continued until ditches were dug and the land, for the time being, became fairly well drained. Besides the sedges and grasses the most common plants were

- Typha latifolia*—(Cattails);
- Phragmites phragmites*—(Reeds);
- Eupatorium perfoliatum*—(Boneset);
- Aster* (several species)—(Wild asters);
- Potentilla fruticosa*—(Shrubby Cinquefoil);
- Betula pumila*—(Low Birch);
- Rhus vernix*—(Poison Sumac, or Poison Elder.);
- Helianthus* (several species)—(Wild Sunflowers);
- Solidago* { *Riddellii*
and
Ohioensis } Probably—(Goldenrods)

Some less common plants were

- Lacinaria spicata*—(Blazing Star, or Gay Feather);
- Parnassia Caroliniana*—(Grass of Parnassus);

Lobelia Kalmii—(Kalm's Lobelia, or Brook Lobelia);

Lobelia syphyllitica—(Blue Lobelia, or Great Lobelia);

Lobelia cardinalis—(Cardinal flower);

The following plants were more rarely found upon it than in later years

Rosa carolina—(Swamp rose);

Salix (various species)—(Willows);

Urtica gracilis—(Slender Nettle).

Ordinary weeds from cultivated ground were not found growing upon it.

Trees were much less common on prairie in 1833 than in later years. They occurred only on the old clay islands, the sand dunes, and along the margin of the prairie where muck was quite thin. On the portions covered with sedges and grasses, no seedling trees made their appearance.

The first trees to make their appearance were the Willows, Poplars, Elms, and Soft Maples. On the sand-dunes oaks had already made their appearance in 1833.

DRAINAGE OF THE PRAIRIE—PAST AND PRESENT.

From the configuration of the territory embraced in area represented in accompanying map, and from the arrangement and depth of the drift material in the various portions, one would be justified in inferring that the preglacial drainage of this section differed materially from the one in post-glacial times.

The portion of Big Spring Prairie between Carey and Springville, and included between North Ridge and West Ridge, presents a striking resemblance to an old river valley, which might repay investigation by the geologists of the state, who have made extensive investigations along this line in other portions of the state. If this surmise in regard to old river bed is correct, as the evidences seem to indicate, the drift mater-

ials of the glacial epoch were deposited in such a manner that a lake was formed on the present site of the prairie, a greater deposition of drift occurring at the south end of the valley, and also to the north and west of the prairie area.

This lake differed but slightly in outline from the present prairie, and it differed considerably in depth. From borings on this area the greatest depth did not much exceed thirty feet and considerable portions were only a few feet in depth, for in some localities the difference in depth between the surface level and the drift clay or solid rock is quite slight. Bowlders resting on shallow drift clay occur in angle formed by the roadbeds of the Hocking Valley R. R. and the Northern Ohio R. R. and just east of this point, in fact just across the tracks, the Niagara limestone lies scarcely two feet below the surface. Bowlders also occur on a rather large area in the vicinity of Springville. Further investigation would be needed to determine whether the preglacial stream flowed northward or southward between the North and West Ridges.

That this area was a lake in post-glacial times is evidenced by the fact that quicksands, old lake beaches, sand-dunes, etc., exist in various portions. These will be more fully discussed under the various natural areas and plant societies into which the prairie can be divided. When this region was first settled, the natural drainage of the southern portion of the east arm was a broad gradual slope to Spring Run, joining it at the present site of the Gault House, Carey, Ohio. No definite stream existed in this portion within the memory of man; but that such an outlet formerly existed is evidenced by the fact, that the nearly obliterated remains of a beaver dam occurs in the southern portion of this area. It extended in an easterly and westerly direction about half way between Dow street and the Northern Ohio R. R. It filled the gap between the

slope of West Ridge and the locality just across the Hocking Valley R. R., where the Niagara limestone lies within a foot or two of the surface.

The northern portion of the prairie from Springville westward was drained by the outlet mentioned in the treaty, which was made with the Wyandot Indians in 1818. The Blanchard River is about five or six miles west from the western boundary of the Indian Reservation. In the treaty this would scarcely be referred to as the head-waters of Blanchard's Fork, so there must have been a tributary of this name sufficiently open to warrant mention. According to the testimony of the older settlers, there was no well-defined open stream in 1840. Blanchard's Fork must have gradually become clogged up by an encroaching growth of cattails, sedges, grasses, water-plants, and arrow-leaves: thus producing the sluggish outlet frequently mentioned by the old settlers.

The southwestern extremity of prairie near Vanlue had a broad sluggish drainage to the southwest along two shallow valleys.

Whether all of these outlets existed when the area was a lake, or originated after it had developed to the marsh type, it is difficult to determine: but, most probably the outlet was the only one, the others originating after the surface of marsh was built up higher than the original level of the lake.

This would seem to be a natural consequence, for there are several areas of limited extent in various portions of the prairie which would corroborate this view. These areas are elevated several feet above the surrounding level, although they consist of muck, of as great or greater depth than the adjoining portions. This greater elevation of a portion of a marsh is a common formation in a Sphagnum swamp. The writer has never been able to find any Sphagnum whatever on this area, or any traces of it in the muck, although

Dr. W. A. Kellerman and myself have made microscopic examinations of muck obtained in localities where it would have been most likely to occur. It either existed formerly, even if no traces have been found, or other forms of plant life possess the same power. As before mentioned a remnant of the old lake existed as late as 1850, occupying a portion of the bed of the old outlet, or Blanchard's Fork.

By an inspection of the Map, it will be seen that the drainage at present is in the same three general directions as mentioned under natural drainage while the area was a marsh. The Divide occurs along New Road No. 1. The territory to the south of this road is drained into Spring Run, the water eventually finding its way into Sandusky Bay by way of Tymochte Creek and Sandusky River.

The ditch, draining into Spring Run, does not follow the natural drainage course to vicinity of Gault House, but veers eastward just north of Carey and empties into the Run near the Hocking Valley Depot. The territory north of the Divide is drained northward, then westward and empties into the Bower Ditch just west of the Seneca-Hancock County line. The waters of this ditch reach Lake Erie via the Blanchard, Auglaize, and Maumee Rivers. The Vanlue end of prairie is drained by several ditches whose waters empty into the Blanchard River.

ARTIFICIAL DRAINAGE AND ITS EFFECTS.

The first drainage ditch was dug about 1860. This drained the old lake remnant, and led to the gradual decrease in strictly hydrophytic plants. The second ditch drained into the old lake bed. It extended from the western edge of prairie, eastward along Seneca-Wyandot County line, and then northward along the eastern margin of prairie, then northwestward, empty-

ing into the old lake bed. The third ditch extended from the vicinity of New Road No. 1 chiefly along the western portion of prairie, then along southern border, and emptied into Spring Run as at present. A number of lateral ditches draining into these were dug. As a result of this drainage, portions of the prairie became fit for cultivation, other portions formed excellent pasture lands.



FIG. 1.—BOWLDER SHOWING SETTLING OF SOIL

Although the drainage ditches were occasionally cleaned out and deepened, in the course of years, the area began to revert to the marsh type. The flow of the water became more and more sluggish. It was found necessary to abandon some of the cultivated portion as it could no longer be properly drained. An unlooked for result had occurred. The general level of the drained portion of the prairie was lowered to such

an extent, that the mesophytic condition was gradually reverting to the hydrophytic condition again.

As evidence of the settling of the soil and the extent of the settling, we would call your attention to figure 1 which shows a large boulder resting on drift clay. The location of this boulder is indicated on the Map. The dark band along the side of rock near the top marks the old marsh level; the shorter band of dark and light streak near the base of rock was exposed by prairie fire which burned the soil several years ago. The picture does not do justice to the real appearance of the rock. The portion above the upper band is old and exceedingly weatherworn, and partially covered with mosses. The portion below the upper band has a clean, bright surface as if it had been more or less acted upon by humic acids. The difference in the appearance of these distinct areas is far more striking on the boulder than in the picture. The decrease in level of this part of prairie is thus shown to be about $2\frac{1}{2}$ feet.

Mr. Peter Brayton states that when a young man, he was one day walking across prairie not far from the edge, a short distance north of New Road 2, which crosses his farm. The ground was wet and springy. At each step, his feet would sink into the muck. He happened to step upon something solid. Upon investigation, he found it to be a boulder, whose top was slightly below the surface. In 1899, the boulder was projecting about 20 inches above the surrounding level. This seeming elevation of boulder, and actual settling of soil occurred after artificial drainage was introduced.

The old settlers are quite unanimous in their testimony, that a person could shake many square rods of ground by jumping upon one of the "bogs" as they called the "sedgy hummocks" projecting above the general level; and also, that portions of prairie muck seemed to be quite deep as poles could be thrust vertically into the soil to the depth of ten feet or more. At

present, they are at a loss how to account for the fact, as the muck in those identical places is now only three or four feet deep. Below the muck, there is either a sand bed, a layer of clay or both. The testimony of the bowlders clears the mystery, for the muck was formerly deeper, and the sand-layer beneath was a quicksand, such as is yet encountered while making



FIG. 2.—TREE WITH EXPOSED ROOTS, SHOWING SETTLING SOIL.

excavations for the abutments of some of the bridges across the prairie streams. When thoroughly drained, the quicksand becomes a solid bed. The settlers, ignorant or unmindful of the quicksand beneath, were mistaken in supposing that the entire depth penetrated was muck.

As further evidence of the amount of settling of the soil, we would direct your attention to figure 2.

This tree is situated in a low woods, adjoining the prairie and at the junction of a shallow drainage valley from West Ridge. It is about two rods distant from the ditch draining southern part of prairie. The tree is 59 inches in circumference just above the exposed roots. The amount of settling indicated is about $2\frac{1}{2}$ feet. Figure 3 shows another tree 36 inches in circumference. It is situated in same woods, but a short distance up the slope of this natural drainage valley. The amount of settling at this point is about 24 inches. Considerable of this settling was due to the last deepening of the outlet of this prairie ditch in 1897.

Several wooded areas of this prairie, whose principal genera are *Ulmus*, *Fraxinus*, and *Acer* exhibit a like tendency to prominent or exposed roots. Whenever the roots of trees are imbedded in a solid clay subsoil, and the soil settles, it will leave the upper roots exposed as illustrated in figures 2 and 3. Thus, in part, we can read the history of the past of such areas by the present conditions.

Since the settling of the soil tends to cause a reversal of the plant societies, it is of considerable interest to further investigate the subject of drainage and its effects; especially as prairie fires which burn the soil as well as the vegetation upon it are, upon this prairie, a direct result of artificial drainage. Before artificial drainage was introduced, the burning of the soil did not occur, as the muck was surcharged with water. The enclosing ridges and the solid rock bed underlying the prairie renders this a peculiar kind of prairie. The edge of the prairie is lined by a number of springs, the natural outlets of the subterranean drainage of the ridges; the rock strata of these ridges, as before explained, dipping toward the low ground and hence in this region toward the prairie, the subterranean water must rise in prairie muck until it rises sufficiently high to be drained off by the prairie ditches. For this reason,



FIG. 8.—TREE SHOWING SETTLING OF SOIL BY ITS EXPOSED ROOTS.

most of the earlier ditches were dug chiefly along the edges of prairie, thus intercepting the waters from the springs. The destruction of the forests on the ridges, and the construction of tile ditches and open ditches have considerably lessened the importance and magnitude of the springs along the margin of prairie, thus aiding in the evolution of plant societies. After the soil became drier, and especially after the construction of the Hocking Valley R. R. across this area, prairie fires became prevalent.

In order to investigate the amount and causes of the settling of the soil, direct experiments with soils were performed. Samples of soil were collected, weighed, and measured while still wet. After thoroughly drying in a slow oven, the soil was again weighed and measured. The dry soil was then burned, and the weight and volume of ash determined, in order to learn what amount of settling of soil was due to prairie fires and what amount to drainage. These prairie fires have rapidly changed a mesophytic area to a hydrophytic one, extensive depressions occurring on the areas burned over, and as the drainage of the ditches became more sluggish, these depressions would fill with water, which would scarcely dry up even in dry seasons. A number of such areas came under the writer's observation between 1891 to 1897. In the latter year the outlet was deepened by blasting the rock in bottom of ditch from the point where the outlet empties into Spring Run to the bridge just north of the Northern Ohio railroad station. The point where deepening ended is shown in figure 4, the rude fence marking the limit.

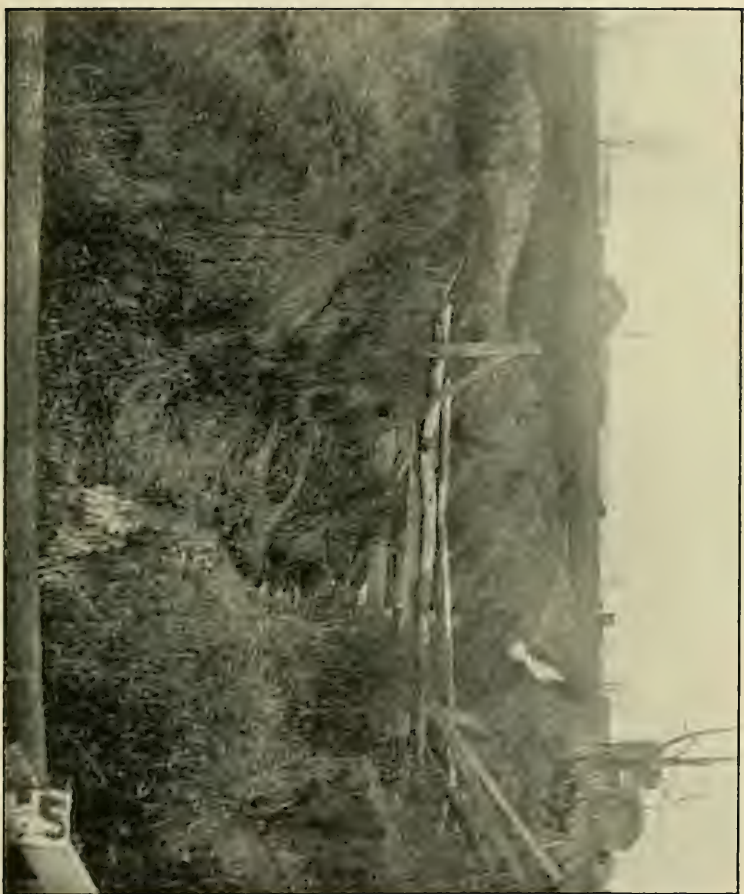


FIG. 4.—SHOWING THE BROWN DITCH AT WESTERN LIMIT OF DEEPENING.

EXPERIMENTS WITH SOIL.

Soil No. 1, taken from the bottom of a ditch 6 feet deep near the Johnson celery farm, gave the following results:

Wet soil, after draining 48 hours.....	160 oz
Dry soil, (dried in slow oven).....	20 oz
Loss in weight.....	140 oz
Loss %.....	87½ %
Volume of wet soil.....	4 qt
Volume of dry soil.....	1¾ qt
Loss in volume.....	2¼ qt
Loss %.....	56¼ %
Volume of dry soil..... 1 qt. 1 pt.	2 gi.
Volume of ashes.....	3 gi.
Loss in volume 1 qt. 0 pt.	3 gi.
Loss %.....	78⅝ %

Soil No. 2, taken from about 10 inches below surface on celery farm.

Weight of soil, undried.....	112 oz.
Weight of soil, dried.....	26 oz.
Loss in weight.....	86 oz
Loss %.....	76¾ %
Volume of soil, undried.....	3 qt.
Volume of soil, dried.....	1½ qt.
Loss in volume.....	1½ qt.
Loss %.....	50 %
Volume of dried soil.....	12 gi.
Volume of ashes.....	3½ gi.
Loss in volume.....	8½ gi.
Loss %.....	70⅝ %

Soil No. 3. Clay subsoil, taken from wooded area near south end of prairie.

Weight of clay undried.....	14 lb.
Weight of clay dried.....	11 lb.
Loss in weight.....	3 lb.
Loss %.....	21⅔ %
Loss in volume slight.	

Soil No. 4. Clay mixed with sand, taken from edge of ditch at south end of prairie.

Weight undried.....	20 lb.
Weight dried.....	16 lb.
Loss in weight.....	4 lb.
Loss %.....	20 %
Loss in volume slight.	

Soil No. 5. Taken from field E. of Map II.

Weight of wet soil, drained 24 hours.....	72 oz.
Weight of dry soil.....	32 oz.
Loss in weight.....	40 oz.
Loss %.....	55 %
Volume of wet soil.....	4 pt.
Volume of dry soil.....	2½ pt.
Loss in volume.....	1½ pt.
Loss %.....	37½ %
Volume of dry soil.....	2½ pt.
Volume of ash after burning.....	1¼ pt.
Loss in volume.....	1¼ pt.
Loss %.....	50 %

	Loss per cent. in weight in drying.	Loss per cent. in volume in drying.	Loss per cent. in volume in burning.
Soil No. 1, Muck from depth of 6 ft.....	87½	56¼	78⅞
Soil No. 2, Muck from depth of 10 inches...	76¾	50	70⅝
Soil No. 3, Clay subsoil.....	21⅔	slight	
Soil No. 4, Clay mixed with sand.....	20	slight	
Soil No. 5, Muck from cultivated surface...	55	37½	50

From the above data, we see that the surface soil has lost $37\frac{1}{2}$ per cent. in volume, the soil at a depth of 10 to 12 in. 50 per cent., while the soil from a depth of 6 feet lost $56\frac{1}{4}$ per cent.

Under natural conditions, the soil will not dry as thoroughly, and in consequence will not lose as great a per cent. in drying, perhaps considerably less than half; but the ratio of loss will remain approximately the same. The soil from near the surface lost less in volume because it contained a smaller amount of water, and because the vegetable matter of which it is chiefly composed had already undergone some oxidation.

Chemistry teaches us that a slow oxidation will practically accomplish in the course of years what a rapid combustion will accomplish in a few hours.

The burning of the deeper soil gave a loss of $78\frac{6}{7}$ per cent., of the soil from near the surface $70\frac{5}{6}$ per cent. making a difference of 8 per cent. Thus a partial oxidation of soil had taken place in the latter and a consequent decrease in volume resulted. As this area had been drained but a few years, we can gain some idea of the importance of this phase of the subject. A complete oxidation of the vegetable portion of the soil will cause approximately the same decrease in general level as the burning of the soil, which has been occurring of late.

There are four causes at work in reducing the general level of this area:

- 1st. Withdrawal of the water from the soil and the consequent shrinkage in volume as determined by direct experiment.

- 2d. Drainage produces aeration of soil; and the resulting oxidation of its vegetable remains, by which great portions pass off as gases, cause the remains to settle more closely together.

- 3d. Burning of the soil, which produces most rapid and greatest difference in level.



FIGURE 4. SHOWING BRUSHING OF SOIL AND MEANS EMPLOYED TO PREVENT ITS SPREADING.

4th. The erosion of surface soil in the vicinity of ditches.

The above four causes are direct results of artificial drainage.

This settling of marsh soil after drainage becomes of economic importance. For, if there is just enough difference in level to secure proper drainage when the first ditches are dug, the area in the course of years, is bound to revert to the semi-marsh type, if the muck is sufficiently thick.

If, however, the fall in outlet ditch is sufficiently great, the ditches must be deepened from time to time, until the first two causes have approximately accomplished their work. The third force or cause does not manifest itself on all drained marsh areas. But wherever it is liable to occur, provision must be made both for prevention, if possible; and for staying its destructive progress.

Figure 5 illustrates a method employed on Big Spring Prairie to stay the ravages of prairie fires. The dry prairie grass was set on fire by sparks from a passing engine. The sedgy or grassy hummocks projecting above the general level are quite dry, and hence are set on fire by the burning grass. The heat from this burning portion expels the moisture from the soil in immediate contact with it and raises it above the igniting point and the fire spreads. Before the real value of this marsh land was learned, little effort was made to check its progress unless it threatened to encroach upon fences or the land adjoining prairie. But, after Mr. W. C. Johnson proved the value of this marsh land by developing a celery and truck farm upon it, the land rose in value from \$10 an acre to \$75 or even more.

At present if a prairie fire originates, which threatens the burning of the soil, a trench is dug around the burning area. If the trench is deep enough to reach very wet soil, it effectually prevents its further ravages

as shown in the illustration. This settling of drained marsh land is not peculiar to Big Spring Prairie, but was noticed by the tillers of the Scioto Marsh. This marsh was formerly wooded. After it was drained, the land was cleared and cultivated. After ten to fifteen years of cultivation, the stumps seemed to be growing in height, and logs imbedded under the surface were exposed. The amount of settling varied from one to two feet. The farmers of that section ascribed the apparent elevation of the stumps to the settling of soil consequent upon cultivation.

The first and second causes above enumerated are sufficient to account for the amount of settling of the soil. Mr. W. C. Johnson, former proprietor of the Wild Rose Celery Farm, stated that the Creston, O., marsh had settled at least ten feet, and that Mr. John Brinkerhoff, the surveyor, who has frequently surveyed and leveled the marsh for securing data of water level for ditching, has observations to this effect on record. Formerly this marsh possessed a slow natural drainage, now a ditch about ten feet deep scarcely drains it.

Under this subject, it may be of interest to give graphic representations of the advance or retrogression of plant societies under varying conditions.

We shall employ Warming's three classes of Xerophytes, or drought-enduring plants; Hydrophytes, or water-loving plants; and Mesophytes, or plants thriving best in medium condition of moisture. The class Halophytes may be ignored in this connection.

The process of the filling up of a shallow lake margin is quite rapid from the time the first bulrush makes its appearance above the water, until the area so covered has been transformed into a marsh, which is covered with water for only portions of the year. From that stage to the strictly mesophytic prairie the advance becomes gradually slower and slower, as portions of the vegetable remains by the alternate soaking and dry-

ing pass off as gases, and thus a correspondingly less amount of humus is accumulated.

The rapidity of the above mentioned process was strikingly exhibited by a pond on the Lawrence Straw farm in the Sandusky River Valley. This pond came under the writers observation in 1893. At that time there was still a small area of clear water in the center for the greater portion of the year. The remainder of pond was covered with quite shallow water, in which there flourished a rank vegetation of cattails, calamus, and various sedges. At present there is no longer any clear area of water, at any time of the year; and the greater portion of the original pond is now above the permanent water level for by far the greater portion of the year. This advance has been made in ten years. As this dead pond is enclosed on two sides by high hills, and as several deep gullies discharge their waters into this area, the erosive material carried into it was an important factor in its rapid advance. But the like factor existed formerly in regard to Big Spring Prairie, as West Ridge fills in the inner curve of the bow, and North Ridge extends along its eastern border. The present broad, shallow drainage valleys were formerly narrow and deep gullies carrying into the old lake a large amount of silt consisting of sand and clay, which were deposited in different places in varying proportions.

The following figure will illustrate the foregoing graphically under the condition of natural drainage:

XEROPHYTIC

MESOPHYTIC

HYDROPHYTIC

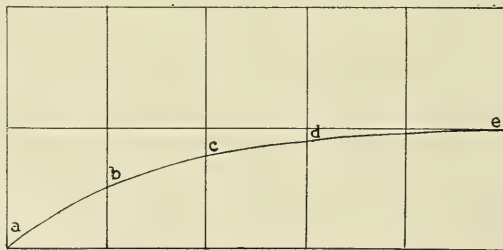


FIGURE 6. DIAGRAM OF CURVE OF ADVANCE UNDER NATURAL DRAINAGE.

Horizontal lines indicate time. Vertical lines indicate rapidity of filling up or change.

a—First bulrush or tattail making its appearance.

b to c—Curve of advance from shallow lake to marsh.

c to d—Curve of advance from marsh to semi-marsh.

d to e—Curve of advance from semi-marsh to mesophytic prairie.

Under artificial drainage this curve must be modified to meet the new conditions, and hence the following diagram will illustrate it:

XEROPHYTIC

MESOPHYTIC

HYDROPHYTIC

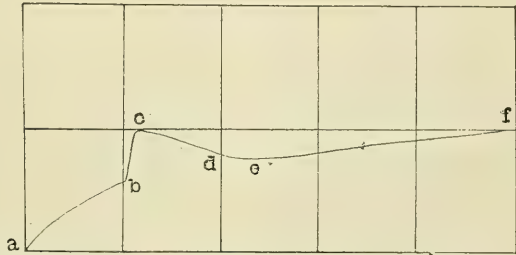


FIGURE 7. DIAGRAM OF ADVANCE AND RETROGRESSION UNDER ARTIFICIAL DRAINAGE.

a—Appearance of first bulrush or cattail.

a to b—Advance under natural drainage.

b to c—Effect of artificial drainage.

c to d—Settling of soil and erosion.

But the condition of greatest water content of soil will not be reached until the outlet ditch becomes completely clogged up with plant remains whose accumulation will be greater here than where there is less moisture. Consequently a barrier retarding drainage will be built up and the conditions on the originally drained portion will for a time become more hydrophytic as indicated by the curve "*d to e*." When "*e*" greatest degree of marshiness has been attained, the natural process of advance will again tend to carry the

area to the mesophytic condition. The above represents the curve if only one effort at drainage has been made. If the ditches are cleaned out or deepened, new curves must be accordingly introduced at the proper stage.

If the soil takes fire after drainage, and a severe burn ensues, the curve will need adjustment as follows:

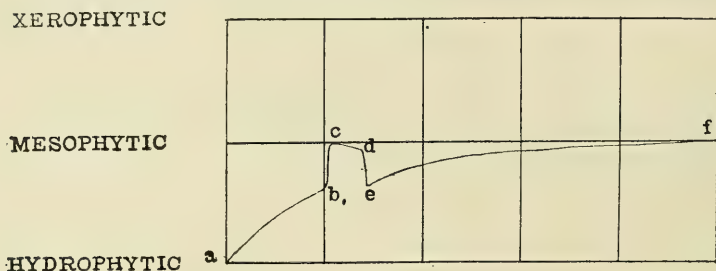


FIGURE 8. RETROGRESSION AS RESULT OF THE BURNING OF SOIL.

a to b—Advance under natural conditions.

b to c—Advance under artificial drainage.

c to d—Stage of settling before prairie fire.

d to e—Retrogression as result of prairie fire.

e to f—Advance under natural conditions.

As before stated, the first ditches were dug about 1860, but by 1890 certain portions of prairie had so far reverted toward former conditions that a joint county ditch was petitioned for and granted by the proper authorities of Seneca and Hancock counties. This ditch was constructed in 1891 and is known as the Bower Ditch as represented on Map I.

Figure 9 gives an illustration of it some distance beyond the prairie area. The greater portion of this outlet is cut through a considerable thickness of clay now quite firm. The muck above it has undergone considerable oxidation and consequent settling. This outlet will furnish adequate drainage for great portions of this prairie for many years to come.

In 1897 it was found necessary to deepen the outlet of the Brown Ditch at southern end of prairie. In order

to secure sufficient fall for further proper drainage, it was necessary to blast out a couple of feet of solid rock for the greater portion of the distance from the bridge just north of the Northern Ohio depot to the point where it empties into Spring Run. A portion of the southern arm of prairie just south of the Carey-Findlay road has been rendered fit for cultivation by means of a very extensive system of underground drainage. A walled catch-basin, receiving the water from several side arms, occurs just south of this road. A large tile drain carries this water to the southwestward.



FIGURE 9. BOWER DITCH JUST BEYOND LIMIT OF PRAIRIE, DEEPENED IN 1891.

4. LAGGING BEHIND OF EFFECTS.

On area D of Map II, although there are ditches on three sides of it producing excellent drainage, yet *Phragmites phragmites* (Reed) still flourishes fairly well. It is not as dense or rank as formerly, but it is yielding very gradually to the changed conditions, and

promises to hold out for some years to come. It is also holding its own in a few other well drained areas.

In the depressions of area F of Map II, *Typha latifolia* (Cattail) was very abundant before the last deepening of ditch, after which a gradual decrease in abundance occurred. Yet it was fairly common even in 1900, the year before the greater portion of this area was brought under cultivation.

Isnardia palustris (Mud Purslane) and *Proserpinaca palustris* (Mermaid Weed) are other striking examples of plants yielding slowly to the changed condition. A specimen of *Proserpinaca* was found late in the Autumn on a piece of ground which had been planted to potatoes. It survived in spite of cultivation, but it had changed its general habit. Instead of growing long and slender, it formed a dense mat about eight inches in diameter, which closely hugged the ground.

Salix myrtilloides and *Betula pumila* are frequently found growing along the well drained banks of ditches three to five feet deep, although they are characteristic swamp plants. The evident explanation of this lagging of effects is found in the facts of well developed root system of most of the plants cited in connection with the great water content of the muck of this prairie.

5. PLANT SOCIETIES OF THE PRAIRIE.

Although there is only a moderate difference in the surface level of the prairie, yet there are quite distinct plant societies flourishing in close proximity to each other. Some times the difference in surface level is not more than one or two feet yet on the slightly higher portion, a mesophytic forest formation may have been developed, while a hydro-mesophytic prairie society may be firmly established on the slightly lower level. Again on another part of prairie considerably higher than the wooded portion, a prairie society may be holding sway. Mere elevation can not reconcile these

seemingly contradictory plant societies. Upon closer examination, it was ascertained that, although the surface level of the muck differed but moderately, the drift clay beneath is not nearly so uniform in level. Consequently, while at some places the clay bed lies one or two feet beneath the surface, at others it lies at a depth unknown at present. On account of the dip of the rock strata of the ridges adjacent to the prairie, the lower strata of muck are surcharged with water, which prevents excavating a hole deep enough to determine depth of muck. A long iron pipe or wooden pole might be driven into the muck, but it would be impossible to determine, whether the entire distance of easy penetration were muck, quick sand, or a plastic mixture of sand and clay. For a conservative estimate we may state that the muck in some portions is at least eight or ten feet deep. As there is this difference in the nature and depth of the soil and sub-soil, and as in the neighborhood of the old lake remnant the soil is more sandy than elsewhere, and as the plant societies vary according to these factors, we shall deal jointly of the nature of the soil in the various portions and the characteristic plant societies thereon.

The first division of plant societies on Big Spring Prairie would be the wooded portions, and the Prairie proper. The wooded portions may be classified under the following divisions:

- 1 The Sand Dune Forest.
- 2 The Outcrop Forest.
- 3 The Clay Island Forest.
- 4 The Clay Bank Forest.
- 5 The Burned Area Thicket.

These divisions will be more fully treated of in the division of Forest Encroachment or Introduction upon Prairie, the Order and Cause.

The prairie proper supports various plant societies according to its elevation, proximity to ditches, and ef-

fects of prairie fires in the past. Furthermore, portions of prairie are still natural meadows; others are under a high degree of cultivation; still others were at one time cultivated, but, for a number of years past, have been used for pasturage again. Thus there is presented a varied array of plant societies according to the foregoing conditions and the problem of their ecology becomes quite a complex one.

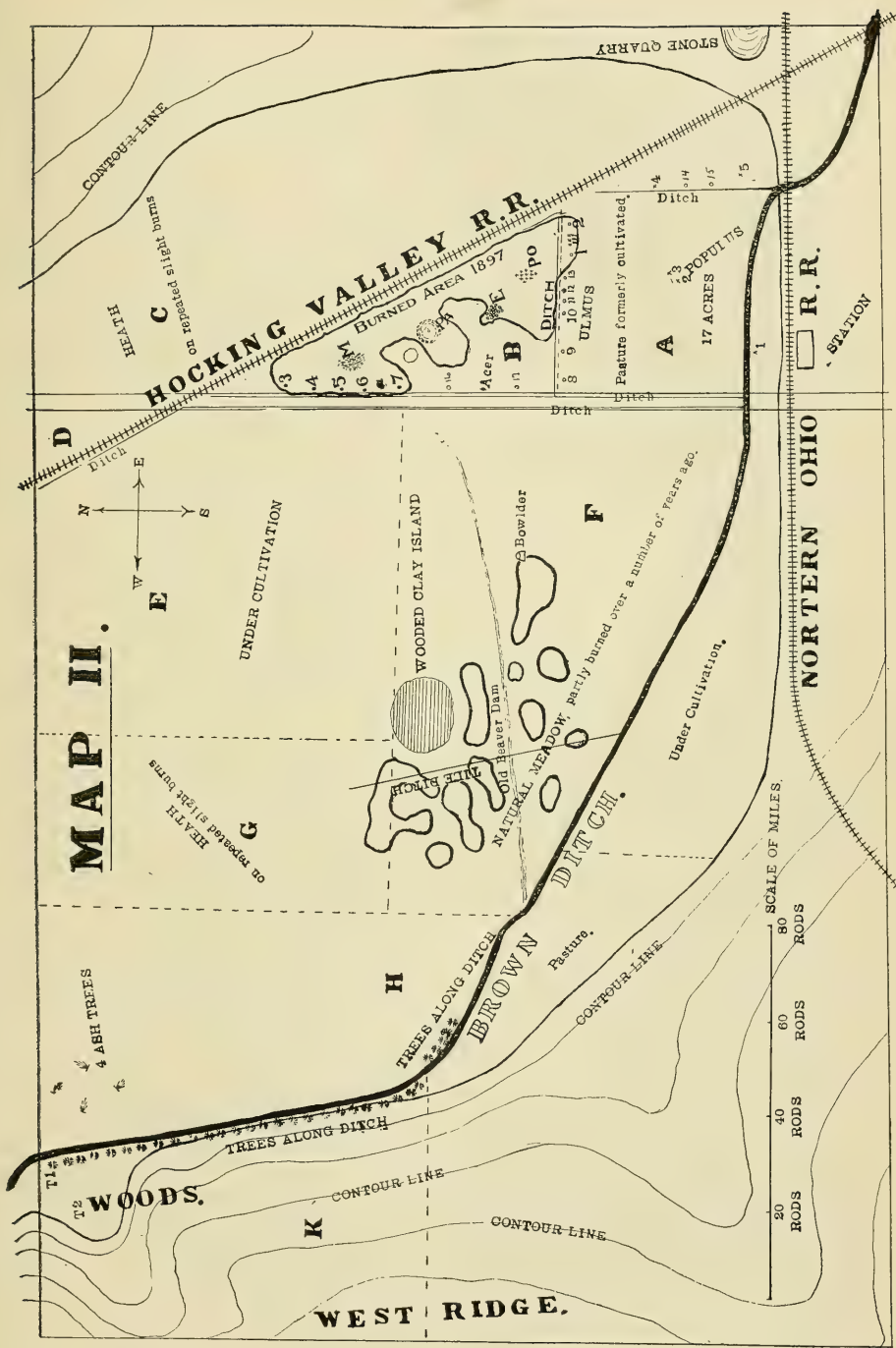
The prairie societies can be considered under the following divisions:

- 1 The Natural Meadow Societies.
- 2 The Heath Societies.
- 3 The Burned Area Societies.
 - a* On severe burns.
 - b* On repeated slight burns.
- 4 Meadow Societies on areas, formerly cultivated.
- 5 The Ditch Societies.

We shall first treat of the contiguous plant societies of the southern portion of the east arm of prairie, as, on the portion represented on Map II, all of the above prairie societies occur, and also some of the woodland societies.

The eastern portion of field "A" is slightly higher than the western, but not more than a foot and a half. Boulders of various sizes are quite numerous in eastern portion, only a few occurring in western portion. The soil in the eastern portion, as seen along ditches is from one and a half to two feet deep, consisting of three layers, a comparatively thick layer of muck, a medium layer of blue clay, and a thin layer of sand resting upon partially disintegrated native Niagara Limestone. The sand was most likely deposited along the shore of the old lake. About two blocks south of this field, the sand layer is considerably deeper as was observed in water-works trenches, which were in line of the original natural drainage course. How the blue clay came to overlie the sand layer is an unsolved problem, unless Les-

MAP II.



quereux's suggestion that the clay in ponds may be formed by remains of *conversoideae* and *characeae* is true.

The soil in the western part of field is from two to five feet deep with a similar arrangement of materials, but the muck and clay are relatively much thicker.

In fields B, F, and C the muck is deeper than in A, with the exception of the wooded clay island and its immediate vicinity. In H, G, E, and D the muck is of still greater depth.

Along the Brown Ditch in eastern portion of field F, the layers of muck and sandy clay are quite prominent, while along the ditch in western portion of field the muck only, is visible.

The surface of this field is quite irregular, especially the western portion, on account of the ravages of one or more severe prairie fires, which left a number of depressions of irregular outline and of varying extent. In 1896, these were from one to three feet lower than the surrounding portions.

Before the last deepening of the outlet of the Brown Ditch in 1897, these depressions contained more or less water throughout the entire year. Although the Brown Ditch was deepened only to the western extremity of field A, the remainder of ditch has become deeper by natural erosion. In 1899, a tile ditch was constructed as indicated on Map II. As a result, the depressions indicated by the banded areas, contained water only during quite wet weather.

In 1896, *Typha latifolia* L. (Cattail); *Isnardia palustris* L. (Marsh Purslane); *Proserpinaca palustris* L. (Mermaid-weed); *Scirpus lacustris* L. (Great Rush); *Ranunculus delphinifolius* Torr. (Yellow Crow-foot); and *Carex* (various species) were the characteristic plants, thus indicating the true hydrophytic conditions. In 1900, the *Typha latifolia* was becoming quite scarce, while the *Ranunculus delphinifolius* had entire-

materially decreased. The *Proserpinaca*, which still maintained its foothold in the lowest depressions, exhibited its characteristic tendency of producing simply toothed leaves instead of the dissected ones which the plant produces, when submerged. As the above species decreased in number, various species of *Carex*, *Scirpus*, and *Agrimonia parviflora* supplanted them.

The characteristic grasses, sedges and rushes of this natural meadow were *Poa pratensis* L. (Kentucky Blue-grass); *Agrostis alba* L. (Red top, Herd's-grass); chiefly in the southern and southeastern portion of field near the ditch; *Muhlenbergia racemosa* (Mx) B. S. P. (Marsh Muhlenbergia); *Scirpus atrovirens* Muhl. (Dark green Bulrush); *Scirpus cyperinus* (L.) Kunth. (Wool-grass); and *Juncus effusus* L. (Bog-rush).

The following were also common: *Spartina cynosuroides* (L.) Willd. (Tall Marsh-grass); *Carex lupulina* Muhl. (Hop Sedge); *Carex Frankii* Kunth. (Franks Sedge); *Carex comosa* Boot. (Bristly Sedge); *Carex vulpinoidea* Mx. (Fox Sedge); *Eleocharis* (species?) *Cyperus flavescens* L. (Yellow Cyperus); *Cyperus erythrorhizos* Muhl. (Red-root Cyperus); *Panicum crus-galli* L. (Witch-grass); *Homalocenchrus oryzoides* (L.) Pool. (Rice Cut-grass); and *Ixophorus glaucus* (L.) Nash. (Yellow Foxtail). The *Poa* and *Agrostis* occur in the best drained portions, while the marsh species flourish in the minor depressions.

The most characteristic herbaceous plants were *Eupatorium perfoliatum* L. (Boneset); *Solidago canadensis* L. (Canada Golden-rod); *Lycopus americanus* Muhl. (Cut-leaf Water Hoar-hound); *Verbena hastata* L. (Blue Vervain); *Asclepias incarnata* L. (Swamp Milkweed); and *Agrimonia parviflora* Soland. (Small-flowered Agrimony).

Other quite common plants were *Potentilla monspeliensis* L. (Bushy Cinquefoil); *Mimulus ringens* L. (Sessile-leaf Monkey-flower); *Penthorum sedoides* L.

(Ditch Stone-crop); *Cardamine pennsylvanica* Muhl. (*Pennsylvanica Bitter-Cress*); *Epilobium lineare* Muhl. (*Linear-leaf Willow-herb*); *Polygonum* (4 species); *Coreopsis tinctoria* Nutt. (*Garden Tickseed*); *Iris versicolor* L. (*Large Blue-flag*); *Geum virginianum* L. (*Rough Avens*); *Urtica gracilis* L. (*Slender Nettle*); *Scrophularia marylandica* L. (*Maryland Figwort*); *Angelica purpurea* L. (*Purple-stem Angelica*); *Mentha piperita* L. (*Peppermint*); *Scutellaria galericulata* L. (*Marsh Skullcap*); *Phytolacea decandra* L. (*Pokeweed*); *Carduus muticus* (Michx) Pers. (*Swamp Thistle*); *Carduus lanceolatus* L. (*Common Spear Thistle*); *Erechtites hieracifolia* (L.) Raf. (*Fire-weed*); *Xanthium canadense* Mill. (*American Cocklebur* and *Ambrosia artemisiaefolia* L. (*Ragweed*). The *Mimulus*, *Penthorum*, *Cardamine* and *Iris* testify to the former marshy condition; the *Epilobium* and *Erechtites*, to the presence of fire.

The *Xanthium* owes its presence most likely to animals, as this field has been used extensively for pasturage. Species formerly fairly abundant in this meadow, but now rare are the following: *Lobelia cardinalis* (*Cardinal Flower*); *Lobelia syphilitica* (*Blue Lobelia*); *Lobelia Kalmii* (*Kalm's Lobelia*. *Brook Lobelia*) *Naumburgia thyrsoflora* (*Tufted Loose-strife*); all witnesses of the former marsh condition. Along the margins of the depressions the following shrubs occur:

Rosa carolina L. (*Swamp Rose*); *Ribes floridum* L. Her. (*Wild Black Currant*) and *Salix* (several species) (*Willows*). *Potentilla fruticosa* so common on other portions of prairie is not found in this meadow.

The wooded clay island will be taken up under the subject of *Tree encroachment upon prairie*.

FIELDS G. AND C.

These were heath-like areas covered chiefly with the following shrubs: *Potentilla fruticosa* (*Shrubby Cinquefoil*); *Sambucus canadensis* (*Elderberry*); *Salix* (several species, *Willows*) *Populus deltoides* and *tremu-*

lides, with *Urtica gracilis* as the most abundant herbaceous plant; and the following quite common: *Koeleria virginiana* (L.) MacM. (Virginia Mountain Mint); *Helianthus giganteus* (Tall Sunflower); *Thalictrum polygamum* (Tall Meadow-rue); and *Carduus muticus* (Michx.) Pers. (Swamp Thistle).

FIELD B.

The unburned portion was still a natural meadow in 1899, and resembled field F. In addition to most of plants found in field F, the following were quite common: *Aster Novae-Angliae* L. (New England Aster); *Aster puniceus* L. (Red-stalk Aster); *Euthamia graminifolia* (L.) Nutt. (Bushy Fragrant Goldenrod); *Lactuca Scariola* L. (Prickly Lettuce); *Asclepias syriaca* L. (Common Milkweed); *Helianthus giganteus* L. (Tall Sunflower); *Onagra biennis* (L.) Scop. (Common Evening Primrose); *Roripa armoratia* (L.) Hitch. (Horse-radish); *Lactuca spicata* (Lam.) Hitchc. (Tall Blue Lettuce); *Potentilla fruticosa* L. (Shrubby Cinquefoil); and *Rubus occidentalis* (Black Raspberry).

In the Autumn of 1897, the shaded portion was severely burned. As a result the elms numbered from 1 to 7 were destroyed. The fire, burning the soil and roots from under the trees, caused them to fall, but yet did not consume them.

In 1898, the severely burned spaces were covered with mosses (chiefly *Funaria hygrometrica*) and a few annual herbs. In 1899, some of these spaces contained hundreds of seedling elms and poplars; others were covered with rosettes of *Onagra biennis* and *Epilobum coloratum*; others, with *Muhlenbergia racemosa*; still others with *Panicum capillare*. Each of the foregoing have seeds that are readily disseminated and the ash of the muck does not seem to be detrimental to their germination. The south portion of the burned area contains more of the seedling elms and poplars than the re-

maining portion on account of its proximity to the seed bearing trees to the south and west of it.

FIELD A.

We treated first of the area surrounding this field so that we might note what plants from natural meadow were able to regain a foot-hold on this area; and what new species were competing with them.

This field has not been cultivated since 1886, and was sown to the following grass seeds: *Poa pratensis*, *Agrostis alba*, and *Phleum pratense*.

The trees occurring in this field are *Populus monilifera* indicated by x1, etc., and *Ulmus Americana* indicated by small circles. The diameters of the *Populus monilifera* were as follows: x1, two feet; x2, three feet; x3, one and one-fourth feet; x4, two and one-half feet; x5, one and one-half feet. The diameters of *Ulmus Americana* were 8, ten inches; 9, two and one-half feet; 10, one and one-fourth feet; 11, one and one-fourth feet; 12, one and one-half feet; 13, one one-fourth feet.

The trees are in a very flourishing condition, but the roots of those in the middle and eastern portion of field are very shallow, some radiating above the ground, partly on account of the settling of soil, partly on account of the shallow soil over the native rock. Dr. Asa Brayton, who owns the field states that the trees are voluntary, and that only a few of the largest were present before the ditches were dug.

The principal plants of the natural meadows to the West and North which have gained a foot-hold, are: *Koellia Virginiana* (L.) MacM. (Virginia Mountain Mint); *Vernonia fasciculata* Michx. (Western Ironweed); *Agrimonia parviflora* (Small-flowered Agrimony); *Euthamia graminifolia* (Bushy Fragrant Goldenrod); and *Solidago canadensis* (Canada Goldenrod). The following plants occur less abundantly than the above, but yet are quite common: *Aster Novae-Anglie* (New England Aster); *Lycopus Americanus* (Cut-leaf Water

Hoar-hound); *Eupatorium perfoliatum* (Boneset); *Potentilla monspeliensis* (Bushy Cinquefoil); *Aster vimineus* (Small white Aster).

The following occur still less frequently: *Rosa carolina*, *Asclepias tuberosa*, *Onagra biennis*, *Carduus marianus*, *Iris versicolor*, *Sambucus canadensis*, *Urtica gracilis*. From the cultivated ground the following are the most plentiful: *Achillea millefolium* (Millfoil or Yarrow); *Dipsacus silvestris* Mill. (Wild Teasel); *Oxalis*, (two species) *Ambrosia artemisiaefolia* (Bitterweed, Ragweed); *Chenopodium album* L. (Lambs-quarters); *Amaranthus retroflexus* L. (Rough Pigweed); *Nepeta cataria* L. (Catnip); *Rumex crispus* L. (Curled Dock); *Polygonum hydropiper* L. (Water-pepper); *Polygonum persicaria* L. (Lady's thumb); *Leptilon canadense* (L.) Britt. (Horse-weed) and *Convolvulus sepium* L. (Hedge Bind-weed). In the eastern portion of field, there are a few *Crataegus* and one specimen of *Gleditsia triacanthus*.

The introduced species in this field occur most commonly where there are breaks in the sod or upon the soil thrown from the ditches. A dense sod seems to be an effectual preventative against the encroachment of most species of plants. The plants which will gain a foot-hold upon the suitable places are chiefly those which occur on the areas around it to the windward, and under similar ecological conditions of soil, moisture, etc. This fact is strikingly illustrated in comparing field H, a natural grassy meadow along the western border of prairie, with artificial meadow A in the eastern portion. Fields F and B are closely allied in physical and chemical characteristics of soil to field A, and the wind is suitable for seed dissemination, in consequence, we find many species in common.

FIELD H.

This is a natural meadow. It is strikingly different in physical and chemical characteristics of soil from

the adjoining ridge, but very similar to that of F and G to the east of it. Although the prevailing winds are favorable, few if any ridge plants have become established upon it. Again as the prevailing winds are westerly, few of the species occurring on F and G are found upon H, although the ecological factors of nature of soil and water content are similar. The surface is well sodded with grasses and sedges, but very hummocky as shown in figure 10.

The next most characteristic plant is *Iris versicolor* (Iris or Blue Flag). Two species of *Polygonum* occur in moderate quantities. Few other plants are common. The *Iris* occurs also in the northeast corner of woods K.

In the northwestern corner of field there were four Ash trees, having the lower portion of trunk considerably enlarged and the roots prominent.

FIELD D.

Before the deepening ditches in 1897, the most characteristic plant of this small area was *Phragmites phragmites* (L.) Karst. (Reed). It is still quite common. Other fairly common plants *Salix* (several species), *Aster novae-angliae*, *Aster puniceus*, *Solidago Riddellii*, *Solidago Ohioensis*, *Verbena hastata*, and *Urtica gracilis*. One clump of *Chelone glabra* occurred also. The *Phragmites* are witnesses of the low marsh condition, and the *Solidago Ohioensis* and *Riddellii* of the wet prairie. The *Urtica gracilis* gives evidence of the occurrence of prairie fires. That there were no severe burns is evidenced by the fact that marsh and wet prairie species are still the dominant plants.

As the two divisions of Natural Meadows and Heath Societies gradually shade into each other, and as they possess many species in common, we shall treat of them jointly, beginning with the large area, occupying the greater portion of the territory between the two new roads indicated on map I.



FIGURE 10. NATURAL MEADOW, FIELD H OF MAP II. GRASSES, SEDGES AND POLYGONUMS.

In the vicinity of new road No. 1, ditches were dug years ago along the eastern and western margins. As a result of this, the level of the soil along the margins was lowered, while accumulation still continued in the middle; accordingly at the time of the digging of the ditches along the middle of prairie, this portion was higher than that along the edges, presenting the phenomena frequently observed in undrained Sphagnum swamps. At present, there are two higher portions between the middle ditch and either margin of prairie. Although this portion was the highest part of this section, it possessed distinct and characteristic bog features. A short distance south of the divide there were two springs, and north of it three or more springs, of which Ox Spring was the most important. Some of these prairie springs are at present simply large depressions, filled with water during wet seasons, and in dry seasons, barely moist. The abundance of springs in this locality and their former importance, in connection with its position between the two ridges, accounts fully for its being the most elevated portion of prairie. The abundance of water, discharged by these springs, before the ridges were so extensively deforested, was especially conducive to the rapid accumulation of plant remains, as it prevented much loss from oxidation. This area seems to have possessed the necessary conditions for a Sphagnum swamp, but careful microscopic examination of the soil from this vicinity failed to reveal any traces of Sphagnum. Other mosses chiefly Hypnum species are quite abundant in the spring of the year. Since beginning the study of this section, this portion in immediate vicinity of Ox Spring has been brought under cultivation, and displayed a divergence from the general character of the surface soil of the prairie. Irregular patches and streaks of marly deposits occurred here and there. The origin of these deposits is due in great part to the lime deposited

from the evaporation of the water, which overflowed the surface of soil in vicinity of Ox Spring, and in part to the shells of fresh water mollusks inhabiting same.

The water from this spring, and in fact from all wells in vicinity of ridges is heavily charged with lime. This marly soil effervesces briskly when treated with hydrochloric acid. The surface muck to the east of this section is of a deep black color, but at the depth of 3 or 4 feet it is of a brown color, resembling in this respect peat from a *Sphagnum* swamp. A microscopic examination of this brown soil reveals the fact that over nineteen-twentieths of it is composed of purely vegetable matter, the cellular structure being well preserved. This lower stratum has the appearance, and slightly also the odor of well-rotted cow-manure. This brown muck when first exposed possesses a slight ammonia odor, which it soon loses. One form of plant remains consists of a wavy stem with $\frac{3}{4}$ inch internodes. The interior is well-rotted; the bark forms a brownish layer, which, after drying, crumbles under the least touch. It is this brown water-charged muck which gives that extreme spongy character to the soil. It would be interesting, if it were possible to determine whether this brown muck were due to the remains of *Philotria*, *Ceratophyllum*, *Utricularia*, *Myriophyllum*, etc., or to *Typha*, *Juncus*, *Phragmites*, *Carex*, etc.

As before mentioned this vicinity possesses the deepest muck. Fig. 11 represents this natural meadow as viewed northward from the divide. The ditch represented is about 5 feet deep, and flows northward. By a close inspection of the illustration, the surface along each side of the ditch is seen to slope toward it; this slope is due to the settling of soil incident to drainage and aeration. Between this ditch and the western margin of prairie, especially in the vicinity of the springs there occurs a plant society of the Heath type, three of whose species are quite characteristic of peat



FIG. 11.—NATURAL MEADOW LOOKING NORTH FROM THE DIVIDE ALONG NEW ROAD NO. 1, AS SHOWN ON MAP I.

bog formations. It is a Hydro-mesophytic Society, and can best be designated as a *Potentilla fruticosa*, *Betula pumila*, *Salix myrtilloides*, *Rhus vernix* heath. The last three species are the characteristic and common plants of *Sphagnum* swamps, either the simple *Sphagnum* swamp such as occurs at Fox Lake, Wayne Co., Ohio, or the Tamarack Bog as the one on the Calumet flood plain at Millers, Ind.

It is still an unsolved problem whether these species are remnants of a former *Sphagnum* swamp, or whether they are ever associated together on areas where *Sphagnum* moss has never occurred.

Big Spring Prairie marks the southern limit for the range of *Betula pumila* in Ohio. Besides the *Salix myrtilloides*, there also occurs *Salix candida*, *Salix bebbiana*, and *Salix lucida*. The *Salix candida* is the next most common species to *Salix myrtilloides*. Close to the shallow old ditch along the western margin there occur occasional large willows and poplars. In some portions the *Potentilla fruticosa* predominates as in field just south of the divide, while at others there are various combinations of the remaining characteristic species. The remaining shrubby plants are *Rosa carolina*, *Cornus stolonifera*, and *Ribes floridus*, the last the least abundant.

The principle grasses and sedges are *Chrysopogon avenaceus* (Michx.) Benth. (Indian Grass); *Phragmites*, (Reed); and *Carex* (various species).

The principle herbaceous plants are *Solidago riddellii* (Riddells Goldenrod); *Solidago ohioensis* (Ohio goldenrod); *Allium cernuum* (Nodding Onion); *Lacinaria spicata* (Gay feather Devils-bit) and *Dryopteris thelypteris* (Marsh Shield Fern.) In fig. 11, the *Solidagos* are shown to the left of the ditch chiefly.

The *Allium* and *Lacinaria* in field in vicinity of Ox Spring were found to be by far the most abundant on the marly streaks and areas; they occur much less

frequently on the other portions of prairie. This may be a natural hint to the onion growers of this section.

Other species occurring less frequently are *Verbena hastata* (Blue Vervain); *Euthamia grammifolia* (Bushy-fragrant Goldenrod); *Solidago canadensis* (Canada Golden-rod); *Aster novae-angliae* (New England Aster); *Aster puniceus* (Purple-stem Aster); *Aster paniculatus* (Tall White Aster); *Mimulus ringens* (Sessile Leaf Monkey Flower); *Penthorum sedoides* (Ditch Stonecrop); *Asclepias incarnata* (Swamp Milkweed); *Lobelia kalmii* (Brook Lobelia Kalm's Lobella); *Lythrum elatum* (Wing Angled Loosestrife); *Eupatorium perfoliatum* (Boneset); *Eupatorium maculatum* (Spotted Joe Pie Weed); *Parnassia caroliniana* (Grass of Parnassus); *Coreopsis tinctoria* (Garden Tickseed); *Helenium autumnale* (Sneezewort); and *Isnardia palustris* in the lower places. Along over-arching south-bank of a ditch flowing east, about $\frac{1}{4}$ mile south of the divide, there occurred patches of *Marchantia*, *Conocephalus*, and along the north bank, amid some shrubby cinquefoil *Geaster minima* was very common. Various other species of *Geaster* also occur on the prairie.

As we advance northward and eastward from the Ox Spring, the shrubs become less abundant and are also less rank. As the shrubs are low, and the grasses and sedges tall, this field looks like a grassy plain, similar to that shown in fig. 12, which represents breaking of virgin prairie for Celery farm. The taller grasses are *Chrysopogon*, the lower shrubs chiefly *Potentilla fruticosa*. Around immediate vicinity of some of the prairie springs *Cephalanthus occidentalis* (Button Bush) commonly occurs.

Near the Mound Springs occurs the most extensive natural meadow still extant and here also the portion near the series of springs is several feet higher than the prairie west and north of it. On this higher portion, near the margin of prairie the bog conditions are



FIG. 12.—BREAKING OF VIRGIN SOIL ON CELERY FARM. NATURAL MEADOW TO THE LEFT.

more prominent than in the lower area to the west and north, on account of the abundance of water discharged formerly by these springs, which preserved the accumulation of plant remains, as in the neighborhood of Ox Spring. This more elevated portion is characterized by its rather dense sod of grasses and sedges with its occasional *Solidago*, *Eupatorium*, *Dryopteris thelypteris*, etc.

To the west of this area there is another typical *Potentilla fruticosa*, *Betula pumila*, *Salix myrtilloides*, *Rhus vernix* heath, but the *Lacinaria spicata* and *Allium cernuum* are lacking, the soil here being a pure black muck of great depth.

The following are as common here as at Ox Spring: *Solidago riddellii*, *Solidago ohioensis*, *Solidago canadensis*, *Dryopteris thelypteris*, *Aster novae-angliae*, *Helenium autumnal*, *Agrimonia parviflora*, *Coreopsis tinctoria*, *Spathema foetida* is more common.

Ordinary weeds from cultivated ground seldom occur here as few slight, and no severe prairie fires have devastated this portion. The absence of severe prairie fires is chiefly accounted for by its distance from railroad. The sod is broken in such few places that seedling poplars and willows are not common. Still further to the west and north there occurs an extensive heath of the *Rosa carolina*, *Potentilla fruticosa* variety represented in fig. 13.

South of new road No. 2 there is an extensive *Rosa carolina*, *Sambucus canadensis*, *Potentilla fruticosa* heath. No willows or poplars of any consequence occur here now, although numerous young trees were quite abundant eight to ten years ago, as the remains were still strewn about upon the ground, or were still standing as dead trunks. Most probably they were destroyed by a prairie fire, severe enough to kill the trees, not severe enough to burn the soil.



FIG. 13.—ROSA CAROLINA, BETULA PUMILA, POTENTILLA FRUTICOSA HEATH,
NORTH OF CAREY & FINDLAY PIKE.

Just north of the area represented by map II, there occurs a large area which has been repeatedly, but most of it not severely burned. The shrubs on this area are: *Salix fluviatilis* (Sand-bar Willow); *Salix bebbiana* (Bebb's Willow); *Lambucus canadensis* (Elderberry); *Rosa carolina* (Swamp Rose); *Potentilla fruticosa* (Shrubby Cinquefoil); but the *Rosa* and *Potentilla* are not as frequent as on those areas not visited by prairie fires. Occasionally *Populus monilifera*, *Populus tremuloides*, *Rubus villosus*, and *Rubus occidentalis* also occur. Where the sod is most completely destroyed *Urtica gracilis* is by far the most abundant plant, while *Thalictrum polygonum*, *Solidago canadensis*, *Koellia virginiana*, *Epilobium lineare*, and *Eupatorium perfoliatum* are next most abundant, as are also various species of *Bidens*, *Ambrosia*, and *Dipsacus sylvestris*. Where the sod is completely destroyed the *Urtica* and the weeds from cultivated ground predominate; on the other portions the original plants maintain their foothold. Those species with deepseated and extensive underground rootstocks are the most successful ones in holding their own. The general type of plant society of this prairie area would be designated as *Hydromesophytic*.

MEADOW SOCIETIES ON AREAS FORMERLY CULTIVATED.

At western extremity of prairie, and some distance south of the Bower Ditch there occurs a meadow of this type which contains 60 acres. It is extremely well sodded, but has been so closely pastured, that it was impossible to determine the species of grasses, but, most likely, the same combination of grass seeds were sown here as in the meadow just north of Carey. A woods occurred just west of the pasture field. This area differs from the two pasture fields discussed under map II, as there are so few species of plants to be found upon it.

No one species can be considered characteristic or even common. Here and there a stray *Erigeron*, *Potentilla*, *Aster*, *Ambrosia*, *Capsella*, *Ranunculus*, etc. may occur. This is another striking illustration of the results of location, environment, and direction of the prevailing winds; and also of the fact that most seeds require a bare soil for germination. A few smaller isolated areas of this class occur with characters intermediate between the above form and the area just north of Carey as figured on map II.

THE DITCH SOCIETIES

These would be divided into those plants growing directly in the ditches, and those flourishing on the banks. The principal plants growing directly in the ditches of this prairie are: *Lemna minor* (Lesser Duckweed); *Bidens laevis* (Smooth Bur-Marigold); *Coreopsis tinctoria* (Garden Tickseed); *Alisma plantago-aquatica* (Water Plantain); *Bidens frondosa* (Beggar-ticks); *Isuardia palustris* (Marsh Purslane); *Ludwigia polycarpa* (Many-fruited Ludwigia); *Eupatorium perfoliatum* (Bone-set); *Eupatorium maculatum* (Spotted Joe Pie Weed); *Verbena hastata* (Blue Vervain); *Xanthium strumarium* (Cockle-bur); *Homalocenchrus oryzoides* (Rice Cut-grass); *Typha latifolia* (Cat-tail); *Carex* (numerous species) (Sedges); *Bidens connata* (Swamp Beggar-ticks); *Helenium autumnale* (Sneeze-weed) and *Ambrosia trifida* (Horse-weed). Along the banks there flourish chiefly grasses, willows, young elms, young cottonwoods, and a variable number of other species depending upon the nature of the plant societies in the immediate vicinity.

6. TREE INTRODUCTION UPON PRAIRIE, THE ORDER AND CAUSE.

A number of theories have been advanced to account for the absence of trees upon prairies, but few to account for tree encroachment upon same. Most

theories which have been proposed in regard to either are made so general that there are nearly or fully as many exceptions to the rule as there are conformities to it. In the course of time, the forest formation is certain to encroach upon the eastern type of prairie or natural meadow, which, in general, can be more correctly designated as a semi-marsh. The problem before us is to determine the order, cause, and rate of encroachment.

The factors which determine order of tree encroachment upon natural meadow are relative elevation of the various portions, drainage, nature of the soil and the occurrence of suitable bare spots for germination of the seeds.

Drainage may be either natural or artificial. The natural drainage of wet meadows is secured either by the gradual elevation of one portion above another by the more rapid accumulations of plant remains on the former than on the latter, or by the erosion of some adjacent portion. The proper drainage of a portion of prairie remote from an artificial ditch may be secured indirectly by the settling of the soil in the space intervening between the ditch and the remote area. The suitable places for germination and growth of tree seedlings are furnished by sandy beaches, established sand dunes, or exposures of bare soil, caused by either prairie fires or artificial drainage.

On Big Spring Prairie the following order of encroachment has been observed:

1st. On the limestone or outcrop island indicated on map I.

2nd. On the sand beaches and sand dunes of the old lake.

3rd. On the clay banks along margins and on the clay islands of the old lake.

4th. On the bare soil thrown out of drainage ditches, or on the exposed slopes.

FIGURE 11. A NARROW SAND DUNE IN BIG SPRING TOWNSHIP, DESIGNATED IN TEXT AS WEST DUNE.



5th. On areas where sod and surface soil have been burned by prairie fires.

LIMESTONE OR OUTCROP ISLAND.

The highest portion of this area is about four or five feet higher than the surrounding prairie. There is no actual outcrop of Niagara limestone, but it is covered with a rocky clay soil, similar to that of the ridges. When this region came under the writer's observation, it was under cultivation, but some of the original trees were still standing. There were nine oaks in a flourishing condition, and three dead ones still standing. The oaks were chiefly *Quercus alba* (white oaks) There is no doubt but that this was the first wooded area of this prairie, the forest appearing but little later than that on the neighboring ridges, as the island was formerly much higher without doubt, and has been considerably worn down by erosion.

SAND DUNES AND BEACHES.

In Big Lick Township, Hancock county, there occurs an old sand beach or low dune along the slope of ridge as indicated on map 1. This beach or dune was blown up by the north and northwest winds while the prairie site was still a lake. First, a sandy beach was formed, with its three zones of lower, middle and upper beaches as discussed by Dr. H. C. Cowles of the University of Chicago in his treatise "The Ecological Relations of the Vegetation on the Sand Dunes of Lake Michigan." Only here the zones would be narrower, and different species would occupy the upper and middle beaches of this area, from those found on the corresponding zones along Lake Michigan. It would be interesting to know what these first species were, but there is now no means of determining this, and it would be useless to speculate. On account of the slope of the ridge, the sand was blown up the slope

without forming a distinct or characteristic sand dune as commonly understood. It may have been more distinct in the past than at present. Now it may more properly be termed a sand slope.

The characteristic vegetation is quite similar to that found on the north slopes of the ridges, the oaks and hickories predominating. The grass is chiefly *Poa compressa*. A portion of this sandy slope is under cultivation.

In Big Spring Township, Seneca county, there occur three distinct dunes, two of them marked *S. D.* on map I, meaning simple dunes. The one to the southwest, illustrated by fig. 14, will be referred to as West Dune, the other as North Dune. M. D. C. indicates a Miniture Dune Complex.

By inspection of map I, it will be noted that these dunes are located between the Bower Ditch on the north and the outlet of the Big Spring on the south. As a natural stream, the Bower Ditch had eroded a perceptible valley on the ridge to the northeast, and had doubtless carried a considerable amount of silt into the old lake. The natural currents from the Big Spring and those from the south also carry some silt along. As these two silt laden currents encountered the sweep of the prevailing westerly winds, much of this silt was deposited, and in time, formed a sand bar or bank. After portions of this sand bar became sufficiently elevated to remain above the water throughout the year, low dunes would be formed by the action of the winds. Seeds would soon find lodgment, and plant life appear. The same currents which transported the silt, would also transport many seeds. The general order of the advance of plant life on these dunes would resemble that of the sand dunes along Lake Michigan. First, there would appear annuals, then grasses and sedges, which would act as binders of sand and in consequence low dunes would form; after this, shrubs and tree

seedlings would appear. A diversified flora would gradually develop from the natural introduction of various seeds, until we should find just such a flora as is found on the Minature Dune Complex, which is the oldest of these dunes. It was formed by the southwest, west, and northwest winds. The south winds chiefly heaping up the sand carried down from the Big Spring, which at present feeds the artificial lake represented in fig. 15. The surface is quite undulating from the irregular arrangement of the separate dunes formed by the alternate shifting of the winds. The highest portion of this dune complex is about seven or eight feet above the surrounding level. The humus overlying the dune sand is from eight to twelve inches deep. The underlying sand is very fine and a typical dune sand of unknown depth. The depth of humus would indicate that this dune complex is quite old, as would also the fact that this area was densely wooded in 1832, when the Indian Reservation was thrown open to settlement. Its age would also be indicated by its diversified flora.

The wooded area can be divided into the dune complex proper, and a lower portion to the north and northeast of it.

On the dune complex proper, the most abundant trees are:

Ulmus Americana (American Elm); *Quercus alba* (White Oak); and *Acer saccharinum* or *rubrum* (Silver Maple or Red Maple.)

Besides the above the following occur:

Populus deltoides (Cottonwood); *Prunus serotina* (Wild Black Cherry); *Quercus imbricaria* (Shingle Oak); *Fraxinus Americana* (White Ash.)

On the low ground adjoining the following species occur:

Ulmus Americana (American Elm); *Quercus palustris* (Pin Oak or Swamp Oak); *Quercus platanoides*



FIGURE 15. ARTIFICIAL LAKE FED BY BIG SPRING.

(Swamp White Oak); *Acer rubrum* (Red Maple); and *Fraxinus* sp? (Ash.)

The diameters of some of the larger trees were as follows:

White Oak, 32 inches; White Oak, 42 inches; Cottonwood, 38 inches; American Elm, 41 inches, and American Elm, 55 inches.

Thus, the size of the trees corroborate the testimony of the pioneers in regard to the wooded condition of this area in 1832.

On the simple dunes, about the same species occur that are found on the dune complex, but the *Populus deltoides* (Cottonwood) is more abundant as is evident from an inspection of fig. 15, which represents a portion of West Dune, the white-barked trees from the middle to the left of picture being cottonwoods.

As proof of the more recent formation of West Dune, we submit the following diameters of trees:

Populus deltoides (Cottonwood) 24 inches; *Quercus alba* (White Oak) 18 inches; *Prunus serotina* (Wild Red Cherry) 15 inches; and *Ulmus americana* (American Elm) 32 inches. The trees of North Dune are as a rule larger than those on West Dune and not as large as those on the dune complex. Between the two single trees there occurs a solitary *Quercus rubra* (Red Oak) 56 inches in diameter. All of these dunes are characterized by a regular jungle of shrubby plants. On the Miniature Dune Complex the principal shrubs are *Crataegus* (several species) (Hawthorns); *Cornus stolonifera* (Red Osier); *Rhus glabra* (Smooth Sumac); *Rubus villosus* (Common Blackberry); *Rubus occidentalis* (Black Raspberry); *Corylus americanus* (Hazelnut); *Euonymus atropurpureus* (Wahoo, Burning Bush); *Euonymus obovatus* (Running Strawberry Bush); *Vitis* (sp?) (Wild Grape); *Smilax herbacea* (Carrion flower); *Smilax hispida* (Hispid Greenbrier); *Celastrus scandens* (Climbing Bittersweet); *Parthenocissus quin-*

quefolia (Virginia Creeper); *Rhus radicans* (Poison Ivy); *Staphylea trifolia* (Bladdernut); *Sambucus canadensis* (Elderberry); *Lonicera* (sp?) (Honeysuckle); *Spiraea* (sp?); *Viburnum* (two species) (Arrow wood); *Malus coronaria* (American Crab-apple); *Salix* (several species) (Willows); *Populus deltoides* (Cotton wood); *Populus tremuloides* (Trembling Aspen); and *Cornus florida* (Flowering Dogwood). In all there are twenty-five or more species, some forming a sort of zone along the edge of forest.

On West Dune only the following eight shrubs and young trees were observed:

Euonymus atropurpureus (Wahoo); *Euonymus obovatus* (Running Strawberry); *Viburnum prunifolium* (Black Haw); *Rubus villosus* (Common Blackberry); *Cornus stolonifera* (Osier); *Parthenocissus quinquefolia* (Virginia Creeper); *Vitis* sp? (Wild Grape); *Populus tremuloides* (Trembling Aspen.)

The Dune Complex, being richer in genera and species, indicates conclusively its priority in formation. Perhaps the West Dune was formed when there was only a lake remnant, and there was not the same opportunity for the transportation of suitable seeds by water currents, as there was in the case of the Dune Complex. It would also indicate that the seeds were introduced upon the Dune Complex by water currents rather than by wind dispersal, or else the disparity in number of genera and species upon these two dune areas would not be so great, as they are only a short distance apart.

If the prevailing westerly winds were the chief factor in the introduction of new species in this region, the West Dune ought to be much richer in species than it is, as for many years past, it must have intercepted the seeds from this source. Perhaps this accounts for the greater abundance of Cottonwoods on the West Dune.

The density of shrubby growth is fully as great on the West Dune as on the Dune Complex, but there is no sod upon the former, while portions of the latter are densely sodded.

The difference in herbaceous vegetation is still more striking than in the case of the shrubby plants.

On West Dune the following were the principal herbaceous plants:

Galium (two species) (Cleavers or Bedstraw); *Circaea lutetiana* (Enchanter's night shade); *Viola pubescens* (Downy Yellow Violet); *Viola canadensis* (Canada Violet); *Geranium maculatum* (Wild Cranesbill); *Podophyllum peltatum* (May Apple); *Polygonatum biflorum* (Hairy Solomon's Seal); *Scrophularia marylandica* (Maryland Figwood); *Arctium lappa* (Burdock); *Urtica gracilis* (Slender Nettle); *Botrychium virginianum* (Virginia Grape-Fern); *Onoclea sensibilis* (Sensitive Fern.)

On the Dune Complex the following were the most common and characteristic herbaceous plants:

Bicuculla cucullaria (Dutchman's Breeches); *Vagnera racemosa* (False Solomon Seal); *Vagnera stellata* (Stellate Solomon's Seal); *Erythronium americanum* (Yellow Adder's Tongue); *Trillium grandiflorum* (Large Flowered Wake-Robin); *Polygonatum biflorum* (Hairy Solomon's Seal); *Podophyllum peltatum* (May Apple); *Hydrastis canadensis* (Golden Seal); *Ranunculus* (several species) (Buttercups); *Washingtonia longistylis* (Sweet Cicely); *Dentaria laciniata* (Cut-Leaf Pepper Root); *Anemone quinquefolia* (Wood anemone); *Caulophyllum thalictroides* (Blue Cohosh); and *Cardamine purpurea* (Purple Bitter-Cress)

Other common plants are:

Geranium maculatum (Wild Crane's Bill); *Viola* (several species) (Violets); *Scrophularia marylandica* (Maryland Figwort); *Circaea lutetiana* (Enchanter's Nightshade); *Heuchera americana* (Alum Root); *Trios-*

teum perfoliatum (Horse Gentian); *Arisaema triphyllum* (Indian Turnip); *Hydrophyllum virginicum* (Virginia Waterleaf); *Thalictrum dioicum* (Early Meadow Rue); *Urtica* (two species) (Nettles); *Polygonum virginianum* (Virginia Knotweed); *Apocynum androsaemifolium* (Spreading Dogbane); *Zizia aurea* (Early Meadow Parsnip); *Aquilegia canadensis* (Columbine); *Onoclea sensibilis* (Sensitive Fern, *Botrychium virginianum* (Virginia Grape Fern); *Dryopteris* sp? (Shield Fern); *Adiantum pedatum* (Maiden-hair Fern); *Solidago* (several species) (Goldenrods); *Heliopsis helianthoides* (Smooth Oxeye); *Hystrix hystrix* (Bottle-brush Grass); and *Aster* (various species) (Asters.)

In the low portion of the woods were *Eupatorium ageratoides* (White Snake Root.)

The following were rare plants not only for this dune complex, but even for this entire vicinity:

Cypripedium parviflorum (Smaller Yellow Lady's Slipper); *Viola pedata* (Birds-foot Violet); *Unifolium canadense* (False Lilly-of-the-Valley); and *Panax quinquefolium* (Ginseng).

The writer has failed to find the last two specimens anywhere else in this neighborhood during twelve years of botanizing. The first two are rarely found in this vicinity. These are strong witnesses for the comparatively greater age of the Dune Complex over the others, and also of the varied conditions prevailing upon this area in former times.

By an inspection of the above lists it will be seen that herbaceous plants are fully four times as numerous on the Miniature Dune Complex as on the West Dune.

The North Dune contains a few more specimens than the West Dune, but not nearly as many as the Dune Complex. One plant common to the North Dune has not been observed on either of the others, namely: *Spathyema foetida* (Skunk Cabbage), although it is quite abundant on various portions of the prairie.

WOODS ON CLAY BANKS AND CLAY ISLANDS.

These two divisions may be considered together, as the same factors of shallow muck and a clay subsoil are common to both. By even a slight drainage the water will move down the clay incline, giving the proper condition for the development of thickets followed by forests upon it. Mr. Peter Brayton stated that a thicket originated in the vicinity of new road No. 2 after the first ditch was dug. The clay subsoil continues the slope of the adjoining ridge. In consequence, there was developed a thicket extending from a point southwest of the Big Spring in a westerly and southwesterly direction. In 1895 it was far more extensive than is figured on Map I, for by 1899, many acres had been cleared and brought under cultivation.

One of the first trees to make its appearance upon these areas is *Populus deltoides* (Cottonwood), succeeded by *Ulmus* (Elm), *Acer* (Maple), and *Fraxinus* (Ash). The trees in woods just south of new road No. 2 were from 10 to 15 inches in diameter.

Fig. 16 represents Clay Island of Map II. This area in 1899 contained four elms over 3 feet in diameter, and two over 2 feet in diameter, besides a few smaller ones. There were also about 50 small ash trees, some of which originated from the stumps of former larger trees, as sometimes from four to six of these trees are grown together at the base. All of these trees exhibited the characteristic prominent roots. Some of the clay islands were wooded before the first ditches were dug. The effect of ditching was to cause a more rapid encroachment of forest upon the surrounding portions which were underlain by a properly sloping clay-subsoil. By 1886, the forest had encroached considerably upon the prairie to the southwest, south and south-east of it where the proper natural slope of clay subsoil occurred. In this year a severe prairie fire destroyed



FIGURE 16. WOODS ON CLAY ISLAND REPRESENTED ON MAP II.

about all of the trees upon the newly occupied area. Upon most of this area between the depressions represented on Map II, numerous young trees of *Populus deltoides* (Cottonwood); *Populus tremuloides* (Trembling Aspen); and *Ulmus americana* (American Elm), were gaining a foothold.

One of the clay islands in the western part of the prairie contains only Elms. The other clay islands or clay banks represented exhibit slight variations in the relative number of the species enumerated above, but all of the species are characterized by the prominent or exposed roots.

Fig. 17 represents a peculiar formation of a Maple tree which occurs a short distance southwest of one of the clay islands in the western part of the prairie. The clay-bed gradually sloped from the island in either direction. After drainage a seedling maple sprang up and flourished for several years. As the muck is deeper here than on the island, the tips of the larger roots only were imbedded in the clay; as a result the tree could not successfully withstand the strong wind to which it was exposed. When it was blown down, the roots were not broken off as commonly happens, when they are imbedded in hard soil. The roots on the windward side were torn loose, and have decayed as can be noted by a careful inspection of cut.

Those on the side nearest the prostrate trunk were but little disturbed. Hence the tree continued its growth. The principal branches survived in their struggle for existence, the other branches being shaded gradually decayed, and the resulting formation ensued. This is an apt illustration of a successful struggle for existence under adverse conditions. The illustration shows in the back-ground another tree not so successful in its struggle. The mere looseness of soil on prairie where muck is quite deep may be sufficient reason to account in part for the absence of trees of any size on such areas.



FIGURE 17. ALONG EDGE OF A CLAY ISLAND ON WESTERN PORTION OF PRAIRIE.

The area just south of the new road, No. 1, marked W. B. (*wooded bay*) was formerly a bay of the old lake. The silt carried down from one of the drainage valleys gradually helped to fill this up. In time, it passed through successive stages until it became eventually well wooded. The woods was cleared off, and the area was brought under cultivation. At a depth of 10 or 12 inches there is a flaky sort of soil, which burns with a bright blaze similar to cannel coal. The extent of this deposit was not ascertained, but most probably is quite limited in thickness and extent. The texture of this soil is much firmer than the muck on other portions of prairie, and loses less in weight and volume on drying than the muck from other portions of prairie. The loss in burning is considerable, but was not tested quantitatively.

The northeast corner of woods K of map II, was formerly a small bay into which one of the drainage valleys emptied. After it became filled up with silt and plant remains, a marsh condition arose; and such plants as *Iris* and *Spathyema* made their appearance. These plants still survive in the woods in spite of the rather thorough drainage. In this bay there was a gradual slope of the clay bank to the northeast; and after first ditch was dug, seedling elms and ash sprang up in the muck soil, as now there was moving water in the soil instead of stagnant water. The roots extended through the muck and into the clay sub-soil. As the soil settled after drainage, the roots became considerably exposed as represented in figure 2 and 3. After the settling of the soil, some of the trees were blown down as the roots did not furnish sufficient support to resist wind action. Many of the trees are leaning more or less and as some of the exposed roots are gradually decaying, many more will succumb in the near future, and a forest suited to the new conditions will gradually supplant it if left in a state of nature.

APPEARANCE OF TREES ALONG DITCHES.

It is a well known fact that trees and shrubs commonly occur along ditches or water courses even in the west. Whenever drainage ditches are dug upon the eastern type of prairie, a variable number of trees make their appearance along their banks; the number and kind of trees depending upon kind and quantity of seeds finding lodgment upon the bare soil. The amount of seeds received will depend upon proximity to source of supply, and the direction of the prevailing winds at the time of seed-dispersal.

On Big Spring Prairie, those ditches occurring near forests, (especially if the forests are so situated that the prevailing winds can be instrumental in wafting the seeds to the bare soil along them) are apt to exhibit a greater number of species, and also a greater number of individuals of each species, than those ditches not so favorably situated.

Fig. 18 represents a row of trees which sprang up after the digging of the Brown Ditch. This row of trees occurs partly on the western bank of ditch, and partly on the eastern bank as indicated on Map II.

This row of trees consists of

	DIAMETER
79 <i>Ulmus americana</i> (American Elm).....	6 to 30 in.
5 <i>Prunus serotina</i> (Wild Black Cherry)....	3 to 18 in.
3 <i>Platanus occidentalis</i> (Sycamore).....	12 to 24 in.
3 <i>Juglans nigra</i> (Black Walnut).....	6 to 18 in.
2 <i>Fraxinus</i> sp? (Ash).....	10 to 12 in.

The trees occur along the very margin of ditch. The roots on the ditch side are considerably exposed on account of erosion, occasioned by the deepening of the outlet of ditch. From the foregoing list, it is evident that the elms are by far the most abundant species. This is true of nearly all the other ditches. On the very slopes of the ditches along new road No. 1, numerous cottonwoods and willows are springing up, as the



FIGURE 18. TREES ALONG DITCH REPRESENTED ON MAP II.

seeds find such ready lodgment upon this bare soil, and the conditions seem to be suitable for their germination, especially upon the banks sloping to the south. Here there is a proper amount of light and heat in connection with the ever-present moisture in this muck soil. Along some few of the ditches, willows are the predominant trees or shrubs. Maples occur only occasionally.

Most of the trees figured on Map II, originated along ditches, and an inspection will show that elms and poplars are the abundant species.

On the Peter Brayton farm in Big Spring Township, Seneca County, there occurs a peculiar group of trees along one of the ditches. This group comprises several maples ranging from 18 inches to 30 inches in diameter, a few elms, a couple of oaks, a black haw, an ash, a dogwood, and several willows of 14 to 15 inches in diameter.

TREES ON BURNED AREAS.

Prairie fires have been frequently assigned as the cause of prairies and the absence of trees upon them; but on Big Spring Prairie, fires are the direct cause of the encroachment of thickets and forests upon it. If a prairie fire burns simply the tops of the dead grasses, but does not destroy the sod and roots, ordinary weeds make but little headway in gaining foothold. Schimper gives, as the cause of the density of sod, the fact that grasses propagate abundantly by vegetative reproduction, and adds that this very density of grass rootstocks and roots with their great capacity for the absorption of soil moisture is one of the chief hindrances to the germination of the seeds of trees and to the flourishing of tree seedlings. Herbaceous plants, not including grasses, can not engage in contest against woody plants.

On an area on which sod and soil are burned, mosses and a few annual herbs make their appearance

the first year. The herbs become more abundant the second year and tree seedlings also make their appearance at this time.

On Map I, between the Seneca Wyandot County line and new road No. 2, there is indicated the location of one of the most extensive thickets or embryo forests on this prairie. Figure 19 gives a view of this thicket from the southwest. The larger trees to the right are cottonwoods. In the Autumn of 1891 or 1892, a severe prairie fire originated from a spark from a Hocking Valley engine. As a result the sod and soil were burned away to a depth of one to two feet. The year after the fire, mosses and annual herbs appeared, succeeded the next year by seedling cottonwoods and willows.

In 1899, the circumferences of three willows at one foot above the ground were as follows: 11 in., 14 in. and 15 in.; of eight cottonwoods were 12 in., 13 in., 14 in., 16 in., 16 in., 17 in., 17 in. and 18 in. Those of less dimensions were very numerous, thus showing that all the seedlings did not make their appearance the same year. In the latter part of the eighties, a prairie fire burned quite a depression near the railroad, just across from the wooded bay (W. B). The trees sprang up only around the margin. In 1899, the trees, chiefly cottonwoods and willows, were from 7 to 14 in. in diameter.

A short distance northeast from the woods which presents such excellent examples of exposed roots from the settling of soil, as shown so strikingly in fig. 2 and 3, there stood in 1899, a thicket of cottonwoods, trembling aspen, and willows. This area had been burned over some years before, and the largest trees were from 15 to 20 feet high, while there were all gradations down to dense patches of seedlings of the season of 1899. In the autumn of this year, the writer had the opportunity of noting the effect of prairie fire on young trees. A prairie fire burning only the



FIGURE 19. THICKET ON SEVERE PRAIRIE BURN ON THE PETER BRAYTON FARM.

surface covering of weeds and sedges swept over the greater portion of this thicket. In 1900, it was noted that less than half of the seedlings had succumbed to the flames. The remainder were still in a fair growing condition, while on the bare spots many tree seedlings sprang up during this season. In 1901, this area was brought under cultivation, and thus ended any further observations. The herbaceous vegetation in this thicket consisted chiefly of *Urtica gracilis* (Slender Nettle); *Ambrosia trifida* (Horse weed); *Bidens* (various species) (Spanish needles); and *Polygonum* (various species) (Smartweeds); making a rank vegetation for the flames to act upon, and yet only a portion of the young trees were destroyed.

On area B, of Map II, several trees from 8 to 12 in. in diameter were burned down in 1897, but in 1899 tree seedlings were already taking possession of portions of this area. In 1900, it was brought under cultivation, and no further stages could be noted.

On Map I, other detached areas of varying extent are indicated. Each case, upon examination, reveals the fact that destruction of sod is the potent factor in the introduction of weeds and tree seedlings upon Big Spring Prairie, and probably upon any of the eastern type of prairies.

BURIED FORESTS.

While some workmen were digging ditches on the H. B. Phelps Celery and Onion Farm just north of the woods showing settling of soil by the prominent roots, indicated on Map I, numerous trunks of trees were encountered. The diameters of these trees vary from 6 inches to about 3 feet. Near the Brown Ditch the tree remains occur near the surface, while further away the tree trunks were found at a depth of 2 to 4 feet. When this find occurred, the writer surmised that it might be a buried tamarack forest, but a microscopic

examination of numerous specimens proved that none of them were conifers. The species could not be definitely determined, but there is no doubt that several species occurred. The species most probably were cottonwoods, elms, ash, and willows. Even if the exact species can not be definitely determined, the fact remains that a forest formerly flourished on a rather large area, where within the memory of man, only a typical semi-marsh existed. It is also an indisputable fact that this forest was destroyed from some cause, and preserved in an accumulation of plant remains. Since the cause is practically unknown, it may be in order to offer a possible and probable theory in regard to the matter, especially as some further data concerning the depth and nature of the various soil strata have been secured since writing the portion relating to that subject. While drilling a well on the Phelps Celery Farm just south of the Brown Ditch, the following strata were encountered and depths of each were learned:

Muck	6 ft.
Clay shading into marl.....	3 ft.
Marl, quicksand and gravel	9 ft.
<hr/>	
Total	18 ft.

The gravel rests directly upon the rock strata, which are here 18 feet below the surface. About 40 rods or so north of this well, the strata were found to be of the following depths:

Muck	8 ft.
Clay shading to marl	3 ft.
Marl, quicksand and gravel.....	9 ft.
<hr/>	
Total	20 ft.

As the surface slopes from the latter well toward the former, the rock strata are nearly horizontal.

This arrangement and nature of strata proves con-

clusively that this area was a lake in past glacial times, and incidentally corroborates the conclusion that it was a preglacial drainage valley, as the rock strata near the western end of prairie are 30 feet beneath the surface. As the surface level is lower here than at the points before mentioned, it is evident that the stream flowed northward and westward. The gravel, sand and marl were deposited when the lake was quite deep, and before the abundant aquatic plant life became established. The position of the clay bed seems to confirm Lesquereaux's explanation in regard to formation of such strata in ponds and sluggish streams from the remains of chara and allied plants. After bulrushes and cat-tails made their appearance the formation of the muck layer began. After a shallow layer of muck had accumulated over the clay bed, the area must have become sufficiently elevated to secure natural drainage enough to enable tree seedlings to make their appearance. The clay subsoil offered a sufficiently firm support for successful tree growth. After the forest became established, it is possible that the natural drainage outlet became obstructed, perhaps by the beaver dam before mentioned. In consequence the forest would be flooded and the trees destroyed.

Buried forests have also been reported as occurring on the Vanlue end of the prairie, and may in the future be found to have existed on other unexplored portions. It is indeed a peculiar area scientifically, as it is proving practically to the celery and onion growers.

THE PRAIRE UNDER CULTIVATION.

Before the first artificial drainage, the cultivation of any portion of the prairie was impossible. Even after the first artificial drainage, only isolated portions were cultivated. Drainage was resorted to chiefly to render the prairie safer for pasturage, as cattle and horses frequently mired in this marsh.

Corn was the crop most commonly grown, but it was found from experience that only three payng corn crops could be grown on any area consecutively. The first year's yield was excellent in quantity and quality; the second year's good; and the third year's fair. After the third year the yield was small, and of inferior quality. Wheat and oats were tried, but generally proved unsuccessful, as they would go down before they ripened on account of the lack of silicates and potash in the soil. On limited portions where the muck is not deep and, where, at the same time, there is a clay sub-soil, wheat and oats can be successfully grown. These crops prove successful also in immediate vicinity of the sand dunes, as the soil here is quite sandy.

In a field just north of new road No. 2, clover was sown as an experiment, but it did not flourish very well, as too many weeds seemed to be able to gain a foothold and thus crowd out the clover. Several of the areas formerly cultivated have been sown to a mixture of grass-seeds, and furnish excellent pasturage. If not too closely pastured, these areas seem to possess the power of preventing other forms of vegetation from gaining much of a foothold. When too closely pastured, partially bare spots are produced, and here other forms of vegetation establish themselves and gradually encroach upon the pasture land. The large pasture field in the western part of prairie is a good example of the former, while the pasture indicated by *A* on Map II. is a good example of the latter.

In 1895 the Wild Rose Celery Farm was established by Mr. W. C. Johnson, now deceased. Being a practical gardener and celery grower, and being acquainted with the nature of various other drained marsh areas of the state, he recognized the value of this prairie land, which, before this time, was valued at about \$10.00 an acre. After Mr. Johnson demonstrated its fitness for celery and onion culture, the land rose

rapidly in value. Before the real value of the land was known, little effort was made to check the ravages of prairie fires, unless they threatened fences and other property; but now such means are employed as are illustrated by Fig. 5. Mr. Johnson was practically acquainted with the Creston Marsh, Scioto Marsh, Hog Creek Marsh and other similar areas. He knew what amount of ditching was required to render these marshes fit for successful culture of the various crops to be grown upon them. On the Creston Marsh, a five to ten acre field surrounded by ditches is well drained, while but little more ditching is required to drain the Scioto and Hog Creek Marshes. Mr. Johnson, not recognizing that Big Spring Prairie is a peculiar area on account of the great water content of the soil and its capacity for holding same, at first, constructed his lateral ditches 25 rods apart. He soon learned that this was not sufficient to drain this land properly, and, after experimenting, found it necessary to construct either tile or open ditches every 4 rods. On account of the origin of the soil water from the enclosing ridges, the temperature of this soil is lower than that of the other marsh areas mentioned; but this very factor renders this area most suitable for the successful culture of celery and onions. It also accounts for the presence of the *Betula pumila* and the *Salix myrtilloides* on the natural prairie areas. Fig. 20 gives a typical scene on Wild Rose Celery Farm.

In 1901, Mr. Edwin Brown caused the heath *C* of Map II. to be cleared off, and 20 acres of it were planted to onions. This crop netted him about \$1200. This gave an added impetus to the cultivation of the prairie. At present the principal crops are onions, celery, potatoes, and other garden truck. The various onion growers are learning from experience that the amount of drainage required on other marsh areas of Ohio with which they are acquainted, is not adequate for the successful cultivation of the Big Spring Prairie.



FIGURE 20. SCENE ON WILD ROSE CELERY FARM OF MR. W. C. JOHNSON.

For the successful culture of the above mentioned crops, the soil must be treated with fertilizers containing potash and phosphates. On account of the increased value of this land, there will be little of the natural prairie remaining in a few years.

A BRIEF COMPARISON OF BIG SPRING PRAIRIE WITH
OTHER DRAINED MARSHES IN OHIO.

The Scioto Marsh is drained by the Scioto River. There are no enclosing ridges of limestone with their practically impervious inclined strata. In consequence the water content of the soil of the Scioto Marsh is less than that of Big Spring Prairie, while at the same time the oxidation of the plant remains was more thorough. As a result of this the soil of the Scioto Marsh becomes finer under cultivation, and as the water content is less, the dry surface soil is more readily blown about by the winds. From this cause, the onion crop on the Scioto Marsh is frequently destroyed. The wind blows the soil away from the onions, and the roots become exposed, and the crop is thus ruined. This is not so likely to happen on Big Spring Prairie, as the water content of the soil is greater, especially on that portion northwest from Carey, hemmed in by the two adjacent ridges. In 1902, a considerable portion of the onion crop on Big Spring Prairie was injured partly by a late frost and partly by a peculiar sand-blast action of the fine particles of sand driven along the surface by strong winds. The onions were not blown out, as they frequently are on the Scioto Marsh, and the destruction was by no means total. Furthermore, since the above sand-blast action can occur only when the surface soil is dry, and while the onion tops are young and tender; and, as dry weather in the Spring is rather rare in this section, there is little likelihood of frequent repetitions of the above.

The following table gives a comparative view of the constituents of the soil from Hog Creek Marsh, Scioto Marsh, and Big Spring Prairie.

The analyses were made by Prof. Herbert M. Hill, Chemist, University of Buffalo.

Soil From	No.	Nitrogen as Ammonia	Phosphoric Acid P_2O_5	Potash K_2O	Moisture at 100° C.
Hog Creek Marsh...	1	1.26	.10	.10	59.22
" " " ...	2	1.49	.038	Trace	61.81
Scioto Marsh.....	3	1.099	.09	.10	67.38
" " "	4	.95	.13	Trace	66.02
" " "	5	.90	.09	.10	50.01
" " "	6	1.40	.07	Trace	66.36
" " "	7	1.44	.10	.15	53.36
Big Spring Prairie.	8	.99	Trace	Trace	78.01

Soil No. 8 was taken from the Wild Rose Celery Farm, at a depth of about 10 inches. Thus it is evident that the soil from Big Spring Prairie contains most moisture, and that it is not as rich in ammonia and phosphoric acid as the soils from the two preceding marshes. The Castalia Prairie differs radically from Big Spring Prairie, Scioto Marsh, and Hog Creek Marsh. The wonderful springs at Castalia with their immense volume of water, heavily charged with lime and other mineral ingredients, have occasioned extensive marl deposits, which are valuable for the manufacture of Portland Cement. The muck or humus over the greater part of this prairie is very shallow, accordingly, drainage will affect the general level but little. There are some moderately elevated hills to the south of this prairie, while the northern portion slopes gradually toward Sandusky Bay. According to the statements of Mr. W. H. Rowell of Castalia, and other pioneers of that section, the most common and characteristic plant formerly was *Phragmites phragmites* (reed.) At present it occurs only at a few isolated localities,

chiefly along the north and south road some distance west of the Cement Works. On a few limited areas, the muck is deeper than commonly occurs on this prairie. Some years ago, a prairie fire burned the soil on one of these areas, and gradually a forest developed upon it. Southwest of Castalia Station, there occurs a low woods, which about a century ago, was doubtless a portion of the prairie. This woods contained principally the following species:

Populus deltoides (Cottonwood); *Ulmus Americana* (American Elms); *Hicoria minima* (Swamp Hickory); *Quercus macrocarpa* (Mossy-cup Oak); *Celtis occidentalis* (Hackberry); *Tilia Americana* (Basswood, or Linden); *Acer (saccharinum or rubrum)* (White Maple, or Red Maple.) Thus showing a close approximation to the typical mesophytic forest.

Since the artificial drainage of the northwestern portion of prairie, thickets of cottonwoods and willows are springing up, as the humus is thin and extensive marl deposits underlie it. This marl deposit forms a firm support for the roots. Thickets of the same species are also developing upon those portions where the surface soil has been disturbed and then abandoned, but where dense sod occurs on areas formerly cultivated, tree seedlings seldom encroach. Certain portions are almost pure *Potentilla fruticosa* heaths with occasional *Crataegus* scattered about. The following plants occurring on Castalia Prairie do not occur on Big Spring Prairie: *Hypoxis hirsuta* (Star-grass); *Aquilegia canadensis* (Columbine); *Cypripedium candidum* (Small White Lady's Slipper); *Houstonia* (species) and *Gentiana crinita* (Fringed Gentian.) The following common plants of Big Spring Prairie were not found at Castalia: *Betula pumila* (Low Birch) and *Salix myrtilloides* (Bog Willow), thus it is evident that Big Spring Prairie more closely resembles a *Sphagnum* Swamp than does Castalia Prairie.

BRIEF SUMMARY OF FACTS IN REGARD TO BIG SPRING
PRAIRIE

1. Big Spring Prairie is a peculiar marsh area, when compared with other drained marshes of the state.

2. This prairie was most probably a portion of a preglacial drainage valley, and without doubt, a post glacial lake.

3. The water content and capacity of the soil of this prairie is above the average. This fact accounts for the striking lagging behind of effects in regard to plant life.

4. The low temperature of the soil water accounts for this prairie's marking the southern limit for the range of *Betula pumila* in Ohio.

5. Artificial drainage has considerably lowered the general level of the prairie. Occasional deepening of the ditches will be needed on this account.

In the drainage of other marsh areas, this lowering of the general level must be taken into account. There must be sufficient fall in the outlet ditches, not only for proper immediate drainage but for drainage in the future when the soil has settled.

6. Few ridge species of plants ever gain a foothold upon the prairie.

7. Direction of prevailing winds in connection with location of any given area, as along eastern or western borders of same; determines largely the number of species upon it.

8. A dense sod tends to prevent the encroachment of other forms of vegetation, especially tree seedlings. It is not so effective against shrubs as is evidenced by the heath formations.

9. Burning of soil causes reversions of plant societies in the depressions; on others it leads to establishment of forests, This is especially true if the

depth of muck is decreased to such an extent that roots of trees can penetrate to a firmer stratum.

10 Trees require a firm support for their roots. Consequently, successful tree growth can not occur where muck is deep and loose.

11. Order of tree encroachment upon prairie was as follows:

- (a) On limestone island.
- (b) On sand dunes or beaches.
- (c) On clay islands or clay banks.
- (d) Along drainage ditches.
- (e) On severely burned areas.

12. Portions of this prairie were formerly wooded, as is evident from the buried forests. Forests probably destroyed by flooding on account of construction of beaver-dams.

13. The highest portions of natural prairie possess the most distinctive marsh characters.

14. Parallel ditches at intervals of four rods needed to drain this area properly for the successful cultivation of the best paying crops.

PROCEEDINGS OF THE OHIO
STATE ACADEMY OF SCIENCE

VOL. IV.

PART 2

SPECIAL PAPERS, No. 8

The Coccidae of Ohio, I

JAMES G. SANDERS, M. A.

===== COLUMBUS, OHIO =====

1903

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Coccidae of Ohio, I

By

JAMES G. SANDERS, M. A.

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Date of Publication, May 16, 1904.

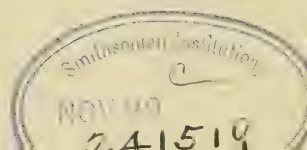
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COLUMBUS, OHIO.
HANN & ADAIR, PRINTERS.
1904



The expense of the publication of this paper is covered by a special grant from the Emerson McMillin Research Fund.

WILLIAM R. LAZENBY,
F. M. WEBSTER,
JOHN H. SCHAFFNER,
Trustees.

*THE COCCIDAE OF OHIO, I

INTRODUCTORY.

This paper is the result of two years' study of the *Coccidae* in the Ohio State University Zoological Laboratory, under the able direction of Prof. Herbert Osborn, who has devoted much time to the study of the Hemiptera, of which Order the *Coccidae* comprise a comparatively small group.

It has been the plan of the author to arrange the paper in the form of an illustrated manual, furnishing keys and descriptions for the species reported in Ohio. Several species were not deemed sufficiently important to require an extended description and a figure. In the course of the work the author has added 32 species to the Ohio list, including six species new to science. One of these (*Aspidiotus glanduliferus*) was described by Prof. Cockerell, and five (*Phenacoccus osborni*, *Chionaspis gleditsiae*, *Ch. sylvatica*, *Aspidiotus piceus* and *Orthezia solidaginis*) were described by the author.

On account of the lack of specimens and literature at hand, the author omits the *Coccinae* in this paper except to list the recorded species, hoping in another year to work up this group in similar manner. Any assistance in the way of specimens or literature will be gratefully received.

In illustrating the *Diaspinae*, the author has shown on one-half of the drawing the dorsal, and on the other half the ventral surface, and has endeavored to be as accurate as possible in delineating the relative size and position of the gland-orifices, both dorsal and ventral.

The male scale has been described immediately after the female scale, it seeming proper to give first the superficial characters of each one before passing to the microscopic characters of either one.

* Presented to the Faculty of the College of Arts, Philosophy and Science of the Ohio State University as the thesis requirement for the degree of Master of Arts, June, 1903
Contributions from the Department of Zoology and Entomology, No. 18.

Mrs. M. E. Fernald's catalogue of the Coccidae of the World has been followed with reference to nomenclature, and all the exotic species are italicized in the text.

The author wishes to thank Prof. Herbert Osborn for his many valuable suggestions during the study of the Coccidae, and the preparation of this paper. Also the author is under great obligations to Prof. T. D. A. Cockerell, Prof. R. A. Cooley and Mr. Geo. B. King for suggestions and verifications of species; and to Dr. E. P. Felt for specimens and literature.

LIST OF THE COCCIDAE REPORTED IN OHIO

(Including greenhouse species, indicated by an asterisk.)

ORTHEZIINAE

**Orthezia insignis* Dougl.

Orthezia solidaginis Sanders.

DACTYLOPIINAE

Asterolecanium variolosum (Ratz.)

Kermes andrei King.

Kermes arizonensis King.

Kermes galliformis Riley.

Kermes kingii Ckll.

Kermes pettiti Ehrh.

Kermes pubescens Bogue.

Kermes trinotatus Bogue.

Gossyparia spuria (Modeer).

Eriococcus azaleae Comst.

Phenacoccus acericola (King).

Phenacoccus osborni Sanders.

**Pseudococcus citri* (Risso).

**Pseudococcus longispinus* (Targ.)

**Pseudococcus pseudonipae* (Ckll.)

Pseudococcus trifolii (Forbes).

COCCINAE.

Pulvinaria acericola (Walsh & Riley).

Pulvinaria innumerabilis (Rathvon).

**Coccus hesperidum* (Linn.)

Eulecanium armeniacum (Craw).

Eulecanium canadense (Ckll.)

Eulecanium caryae (Fitch).

Eulecanium cockerelli (Hunter).

Eulecanium fitchii (Sign.)

Eulecanium fletcheri (Ckll.)

Eulecanium magnoliarum (Ckll.)

Eulecanium nigrofasciatum (Perg.)

Eulecanium persicae (Fab.)

Eulecanium prunastri (Fonsc.)

Eulecanium quercifex (Fitch).

Eulecanium quercitronis (Fitch).

Eulecanium tulipiferae (Cook).

Eulecanium websteri (King).

**Saissetia depressa* (Targ.)

**Saissetia hemisphaerica* (Targ.)

**Saissetia oleae* (Bern.)

DIASPINAE.

Chionaspis americana Johns.

Chionaspis caryae Cooley.

Chionaspis corni Cooley.

Chionaspis euonymi Comst.

Chionaspis furfura (Fitch).

Chionaspis gleditsiae Sanders.

Chionaspis longiloba Cooley.

Chionaspis ortholobis Comst.

Chionaspis pinifoliae (Fitch).

Chionaspis salicis-nigrae (Walsh).

Chionaspis sylvatica Sanders.

**Howardia biclavata* (Comst.)

**Diaspis boisduvalii* Sign.

**Diaspis bromeliae* (Kern.)

- | | |
|---|---|
| * <i>Diaspis echinocacti cacti</i> Comst. | <i>Aspidiotus perniciosus</i> Comst. |
| * <i>Aulacaspis pentagona</i> (Targ.) | <i>Aspidiotus piceus</i> Sanders. |
| <i>Aulacaspis rosae</i> (Bouche). | * <i>Aspidiotus rapax</i> Comst. |
| * <i>Hemichionaspis aspidistrae</i> (Sign.) | <i>Aspidiotus ulmi</i> Johns. |
| * <i>Fiorinia floriniae</i> (Targ.) | <i>Aspidiotus uvae</i> Comst. |
| <i>Aspidiotus aesculi</i> Johns. | * <i>Comstockiella sabalis</i> (Comst.) |
| <i>Aspidiotus ancyclus</i> (Putn.) | * <i>Chrysomphalus aonidum</i> (Linn.) |
| <i>Aspidiotus comstocki</i> Johns. | * <i>Chrysomphalus aurantii</i> (Mask.) |
| * <i>Aspidiotus cyanophylli</i> Sign. | * <i>Chrysomphalus dictyospermi</i> |
| * <i>Aspidiotus cydoniae crawii</i> Ckll. | (Morg.) |
| <i>Aspidiotus forbesi</i> Johns. | <i>Chrysomphalus obscurus</i> (Comst.) |
| <i>Aspidiotus glanduliferus</i> Ckll. | * <i>Lepidosaphes beckii</i> (Newm.) |
| * <i>Aspidiotus hederæ</i> (Vall.) | * <i>Lepidosaphes gloverii</i> (Pack.) |
| <i>Aspidiotus juglans-regiæ</i> Comst. | <i>Lepidosaphes ulmi</i> (Linn.) |
| * <i>Aspidiotus lataniae</i> Sign. | * <i>Parlatoria pergandii</i> Comst. |
| <i>Aspidiotus osborni</i> Newell & Ckll. | * <i>Parlatoria zizyphus</i> (Lucas). |
| <i>Aspidiotus ostreaeformis</i> Curt. | |

KEY TO THE SUB-FAMILIES AND GENERA

Family COCCIDAE.

The following table is adapted from Prof. Cockerell's table in the Canadian Entomologist, xxxi, p. 273, (1899).

Subfamilies

- A. Males with compound eyes; adult female with conspicuous white, waxy lamellae ORTHEZIINAE
- AA. Males with simple eyes,
- B. Abdomen of female terminating in a compound segment; anal orifice hairless; scale composed partly of exuviae; adult female without legs DIASPINAE
- BB. Abdomen not so terminating,
- C. Female with the posterior extremity cleft; anal orifice closed above by a pair of triangular plates; female secreting a waxy scale not separable from the insect COCCINAE
- CC. Not as above; triangular anal plates absent DACTYLOPIINAE

Subfamily ORTHEZIINAE.

- A. Female with 8-jointed antennae (One genus) Orthezia Bosc.

Subfamily DACTYLOPIINAE.

Tribes

- A. Female enclosed in a complete sac of waxy or horny texture; skin usually with figure-of-8 glands; legs absent in adult; larva not fringed with spines

ASTEROLECANIINI

- AA. Female globular or reniform, in a hard shell; anal ring with hairs in larva but not in adult; larva fringed with spines KERMESINI
- AAA. Newly hatched larva with rows of dorsal spines ERIOCOCCINI
- AAAA. Newly hatched larva without rows of dorsal spines—
female with soft, powdery, unarmored body DACTYLOPIINI

Asterolecaniini.

- Insect with a fringe of glassy rods Asterolecanium Targ. p. 33
Kermesini.

- One genus only Kermes Boit. p. 33
Eriococcini.

- A. Female anal ring with hairs; antennae and legs well-formed in the adult; adult surrounded by secretion but dorsally naked Gossyparia Sign. p. 38

- AA. Adult forming a cottony sac; anal ring with eight hairs; caudal lobes long Eriococcus Targ. p. 38

Dactylopiini.

- A. Antennae 9-jointed; anal ring of female with six hairs Phenacoccus Ckll. p. 39

- AA. Antennae 8- (sometimes 7-) jointed; anal ring with six hairs; body oval Pseudococcus Westw. p. 41

Subfamily COCCINAE.

This subfamily, which includes the genera, *Pulvinaria*, *Coccus*, *Eulecanium* and *Saissetia*, is omitted from this paper, but the author hopes to be able to publish later an account of the species reported in Ohio.

Subfamily DIASPINAE.

- A. Scale of female circular to oval with central, sub-central or submarginal exuviae.
- B. Scale of male usually resembling scale of female in color and texture; only slightly elongated.
- C. Last segment of female with six groups of circumgenital gland-orifices Comstockiella, p. 69

- CC. Last segment of female with less than six groups of circumgenital gland-orifices; with much elongated chitinous processes extending anteriorly from bases of lobes Chrysomphalus, p. 69

- CCC. Chitinous thickenings smaller and shorter or wanting Aspidiotus, p. 55

- BB. Scale of male white, delicate and carinated Diaspis, Aulacaspis, pp. 51, 53

- BBB. Scale of male elongated, not white and without carinae Parlatoria, p. 75

segment, are white, waxy plates or lamellae. In the adult female, the lamellae are united posteriorly, forming a long, parallel-sided marsupium, which contains the eggs and young. The arrangement of the lamellae can be better shown by a figure than by description, q. v. Antennae eight-jointed, all fulvous except the black, somewhat fusoid eighth joint; the first joint is very stout, the second the shortest and stouter than the remaining ones. Legs light brown, the darker tarsi bearing numerous fine spines.

Adult Male: The slender dusky body is about 1 mm. in length, and bears two large ovate, transparent wings with two veins united at the base. Wing expanse, 2.5 mm. The last segment bears on either side a long white filament.

Remarks: This insect is a destructive pest in greenhouses, seriously infesting *Lantana*, *Chrysanthemum* and *Verbena* in the Ohio State University Conservatory.

ORTHEZIA SOLIDAGINIS Sanders.

Fig. 57-63, 77.

Sanders, Ohio Naturalist, iv, 4, p. 94 (1904).

Adult female: Length (including marsupium), 6 mm.; width, 2.5 mm. Body completely covered by white waxy secretion in four series; two inner series composed of eight pairs of lamellae extending laterally from median line with tips turned backward and upward, gradually increasing in length to the sixth then rapidly decreasing; the ninth pair jointed at tips forming a ring around anal orifice. The two lateral series are each composed of ten lamellae, all turning backward except the first on either side. The second and third lateral lamellae are subequal, the others increasing in length to the long subequal eighth and ninth, reaching midway on the marsupium; the tenth pair are very short and inconspicuous. A lamella extends downward between the antennae to the ventral surface. The marsupium is fluted on the dorsal surface, plain ventrally and gradually narrowed and elevated posteriorly.

Body, antennae and legs dark reddish-brown. Antennae 8-jointed bearing scattered hairs and with distal ends of joints enlarged; the fusoid eighth joint with a terminal spine and with distal half black. Formula:—3, 8, (4, 5, 2,) 6 (7, 1). Length of joints in μ :—(1) 135, (2) 150, (3) 205, (4) 150, (5) 150, (6) 141, (7) 135, (8) 180. Legs large and strong, rather spiny, with femur and tibia of almost exactly equal length and tarsus more than half the length of tibia; large claw with three to four denticles and a pair of short flattened digitules.

The body is thickly covered with tubules about 20 μ long, and small derm-orifices. The anal ring is elliptical bearing six hairs and a narrow chitinous band on each side of orifice, and is thickly dotted.

Immature stage: Length 3 mm.; width, 2 mm. Completely covered above by four series of waxy lamellae. The two median series consist of eleven short thick lamellae; the 11th pair being very small and the anterior pair protruding forward over the head in a bilobed manner. The first four lateral lamellae are similar to those of the adult, the fifth and sixth pairs are short, the apparently fused seventh and eighth are again longer, giving the insect a rectangular appearance. The ninth lamellae from either side are fused, forming a single long lamella projecting posteriorly on the median line.

On the ventral surface are 12 short, broad, subequal lamellae on each side around the margin of the body, and the entire surface has an armadillo appearance on account of the short plate-like lamellae. This stage has 7-jointed antennae. Formula:—7, 3, 2, 4, (5, 1) 6. (1) 75, (2) 87, (3) 120, (4) 81, (5) 75, (6) 72, (7) 141. The distal half of the eighth joint is black.

Larval stage: With 6-jointed antennae and two series of large, cottony lamellae on the dorsal surface.

Remarks: The author has found only five adults, near Port Clinton, Ottawa Co., O., July 5, 1903. The immature forms have been collected at Port Clinton, Columbus and Georgesville.

Subfamily DACTYLOPIINAE.

This subfamily is represented in Ohio by six genera of more or less economic importance, viz., *Asterolecanium*, *Kermes*, *Gossyparia*, *Eriococcus*, *Phenacoccus* and *Pseudococcus*. The only species which have as yet any economic importance in Ohio, are the "Mealy-bugs," *Pseudococcus citri* and *P. longispinus*.

ASTEROLECANIUM VARIOLOSUM (Ratz.)

Found on *Quercus aurea*, at Mentor, Lake Co., O., by Prof. Wilmon Newell, Feb. 7, 1900. This scale is of very little importance, as far as known in Ohio.

Genus KERMES Boitard.

Globular or reniform Coccids appearing like galls and always found on Oaks; rather large, varying from 3—10 mm. in diameter; segmentation obscure or revealed by dark bands, or by rows of dark spots on both. Anal ring without hairs in adult. Larvae are long-elliptical with a plainly segmented abdomen, which is usually deeply cleft at the posterior extremity, forming two anal lobes which bear each a long hair and one or more shorter ones. Anal ring with six hairs and body fringed with

spines. Antennae 6-jointed. Legs usually strong; tarsi longer than tibiae; knobbed digitules on tarsi and claws.

- A. Scale very convex, approaching a conical form; segmentation well-marked by three to five dark lines andrei
- AA. Scale globular or nearly so.
- B. Small (3—3.5 mm. in diam.) shiny, covered with fine pubescence pubescens
- Larger, (4—6 mm. in diam.),
- BB. Usually longer than broad, with pale longitudinal mid-dorsal line kingii
- C. Grayish-white, marbled with terra-cotta, with three or four contrasty, wavy, dark bands arizonensis
- Dirty-gray with irregular black spots and transverse pale bands galliformis
- Bright argillaceous to dull gray in color, a dark blotch on each side of front and one around anal orifice trinitatus
- AAA. Much broader than long with median longitudinal constriction; conspicuous black spots in transverse rows pettiti

KERMES ANDRIE King.

Fig. 68.

K. andrei King, Psyche, ix, pp. 22, 78, 81 (1900).

K. andrei King, Can. Ent., xxxiv, p. 160 (1902).

"*Kermes andrei* n. sp. Female scale pyriform in shape, very convex, 5 mm. high and 5 mm. in diameter at the base, variable in some individuals which are nearly hemispherical. Surface shiny. Color, light brown, with three and sometimes four very dark brown bands, these variable in length and breadth. There are also several suffused dark brown, blotchy spots and round dots, more numerous around the posterior cleft. Segmentation obscure; a median posterior keel-like prominence, which is very much wrinkled above near the region of the posterior cleft. When boiled in KOH, the derm is colorless. Rostral loop dark yellow, stout, not very long. No antennae or legs observed. The larvae which were formed in the body of the female are yellow, elongate-oval, 360 μ long, 160 μ broad. Antennae 6-segmented, 3 and 6 about equal and longest; 1 next, then 2 and 5 which are equal. 4 is the shortest. Formula:—(3, 6,) 1, (2, 5,) 4. Antennal segments:—(1) 20, (2) 16, (3) 24, (4) 12, (5) 16, (6) 24. Segments 4, 5, and 6 have a few short hairs. Legs short and stout. Femur with trochanter, 76 long. Tibia with tarsus, 68 long. Tarsal digitules, long fine hairs with knobs; digitules of claw reaching a little beyond the claw. Caudal tubercles quite large, each bearing one long stout bristle (120 μ long) and three long stout spines (28 μ long). The marginal spines point backwards and about the same length and breadth as

those on the caudal tubercles. Rostral loop reaching beyond the last pair of legs. Eggs oval 320 mu long, 240 mu broad.

Hab.: Lawrence, Mass., on white and red oaks. Associated with *K. galliformis*, and found singly, not in clusters as in the latter. They are not common, and the species seems to be viviparous." Original description, in *Psyche*, IX, p. 22 (1900).

Remarks: Although the author has been on the lookout for *Kermes andrei* over the state, it has been found in but two localities, at Columbus and at Minerva Park, about eight miles north of Columbus. At Columbus it was found on *Quercus acuminata* and *Q. alba* and on *Q. macrocarpa* associated with *K. pubescens* Bogue.

KERMES ARIZONENSIS King.

Fig. 70.

K. arizonensis King, Ent. News, xiv, p. 21 (1903).

The original description follows:

"*Kermes arizonensis*, n. sp. Dead dry adult females globular, variable in size, transverse diameter 3 and 5 mm. Color grayish-white distinctly marbled with light yellow or reddish-brown, and having four prominent linear transverse dark-brown bands, somewhat wavy, due to quite large pits at intervals; surface not shiny; speckled with minute black dots. Dead dry half-grown individuals, dark red brown. Antennae apparently only 5-jointed; joints, 1 (20), 2 (20), 3 (40) 4 (20), 5 (32) mu long. Derm colorless. Rostral loop stout, dark brown. Mentum small, no legs or other structural characters found.

Hab. On oak at Prescott, Ariz., collected by Prof. T. D. A. Cockrell, March, 1902."

Remarks: Collected by the author on *Quercus alba* at Salem, Columbiana Co., O., Sept. 7, 1903, and determined by Mr. G. B. King. This is a beautifully marked grayish species, marbled with colors varying from light-yellow to reddish-brown.

KERMES GALLIFORMIS Riley.

Fig. 73.

K. galliformis Riley, Am. Nat., xv, p. 482 (1881).

K. galliformis Lint., 12th Rep. Ins. N. Y., p. 316 (1897).

K. galliformis King, Can. Ent., xxxi, p. 139 (1899).

K. galliformis Ckll., *Psyche*, ix, p. 44 (1900).

K. galliformis King, *Psyche*, ix, p. 79, (1900).

The following description is taken from Mr. King's article. "The Genus *Kermes* in North America," *Psyche*, IX, p. 79 (1900).

"A large dark dirty-gray form, which turns to a nearly white color when exposed a season on the twigs. Female scale 6 mm. long, 7

broad, 6 high, with black spots, and viewed with a hand lens, the scale is seen to be covered with minute black specks. Newly hatched larvae dirty-gray."

Remarks: First found in Ohio at Wooster, by Prof. Wilmon Newell.

KERMES KINGII Ckll.

Fig. 72.

K. kingii Ckll., Am. Mag. N. H., (7), ii, p. 330 (1898).

K. kingii Ckll., Can. Ent., xxxi, p. 139 (1899).

K. kingii Ckll., Psyche, ix, p. 44 (1900).

K. kingii King, Psyche, ix, pp. 80, 83 (1900).

Female scale longer than broad; about 5 mm. in length, 4—4.5 mm. broad, and 3.5 mm. high. Almost invariably attaching itself in or at the forks of twigs, or at base of leaf petioles. Color bright ochreous or sometimes lighter, marbled with a more reddish tint, sometimes almost terra-cotta, with pale longitudinal dorsal band crossed at segments by short more or less broken dark lines; otherwise the segmentation is very indistinct. Small dark spots not prominent and scattered rather promiscuously; numerous minute specks discernable with hand-lens.

Remarks: Found by the author at Pomeroy, O., Aug. 28, 1903, on *Q. rubrum*, and later on the same host at Salem, and on *Q. velutina*, associated with *K. pettiti* Ehrh., at Lisbon. The specimens from *Q. rubrum*, at Salem, are much lighter in color than those found on *Q. velutina*, at Lisbon, O.

KERMES PETTITI Ehrh.

Fig. 69.

K. pettiti Ehrh., Can. Ent., xxxi, p. 7 (1899).

K. pettiti Ckll., Psyche, ix, p. 45 (1900).

K. pettiti King, Psyche, ix, p. 81 (1900).

The original description from Can. Ent., xxxi, p. 7, follows.
"Kermes pettiti, n. sp.

"Female scale about 4 mm. broad, 3 mm. long and 3 mm. high, dark-purplish-brown; some individuals of a lighter color and marbled with brown. A distinct longitudinal groove on the meson indicated by a dark line. Surface without minute black specks. Segmentation not very distinct, indicated by rows of black spots plainly seen through a pocket lens. Ventral surface where it touches the bark, flattened and more or less covered with a yellow secretion. Beak very prominent. When removed from twig, scale leaves a whitish powder. When boiled in KOH, derm colorless except numerous brown spots with dark centers scattered over the dorsum. Antennae very obscurely 6-jointed, joint three apparently longest. Legs very small and stout. Tibia as

broad as long, with a stout spine. Femur and tibia almost equal. Tarsus nearly twice as long as tibia. Claw straight."

Remarks: First found in Ohio, by the author, at Cedar Point, on *Q. imbricaria*, June 28, 1903; found later at Lisbon, Columbiana Co., on *Q. velutina*, and at Newark on *Q. imbricaria*.

An undescribed Chalcid parasite, belonging to the genus *Cheiloneurus* is a common foe of this species, about Sandusky.

KERMES PUBESCENS Bogue.

Fig. 55, 67.

K. pubescens Bogue, Can. Ent., xxx, p. 172 (1898).

K. pubescens Ckll., Psyche, ix, p. 44 (1900).

K. pubescens King, Psyche, ix, pp. 80, 83 (1900).

"**Kermes pubescens Bogue.** Female scale spheroidal, 3.5 mm. in diameter, 3 high, pointed and grooved beneath; covered all over with short straggling pubescence. Color rather light brown, with more or less obscure and suffused dark brown bands marking the obsolete segments. Surface shining, with minute concolorous specks but no dark spots or pits." Original description from the Canadian Entomologist, xxx, p. 172 (1900).

The larvae of *K. pubescens* differ from the larvae of any other known species, by having six rows of short conical spines and short caudal setae. The body is narrower and longer and more attenuated posteriorly. In the larvae of *K. pubescens* and *K. ceriferus*, the sixth antennal segment is longer than the third.

Remarks: This species has been found plentifully at Minerva Park, eight miles north of Columbus, on *Q. macrocarpa*. Although there is a Red Oak (*Q. rubrum*) adjacent, there was not a specimen of *K. pubescens* on it.

KERMES TRINOTATUS Bogue.

K. trinotatus Bogue, Can. Ent., xxxii, p. 205 (1900).

K. trinotatus Quaint. & Scott, Cocc. Am., Dec. iii-iv, No. 4 (1901).

"**Kermes trinotatus, n. sp.** Female scale variable in size, averaging about 5.5 mm. long, 6 mm. wide, and 4.5 mm. high; rounded above, somewhat flattened behind, convex beneath, front turned down into a more or less beak-like prominence; median groove obscure or broad and shallow; color varies from bright argillaceous to dull gray; surface uniform, more or less conspicuously speckled with black; segmentation obscurely or plainly marked with dark spots. When the median groove is present, it is crossed with more or less dark lines showing the segmentation. There is a rounded dark spot on each side of the front, and an elongated dark blotch extending for a short distance above and below the anal opening; hence the specific appellation.

"Larvae 416 μ long by half as broad; caudal setae 160 μ long; antennae 100 μ long, 6-jointed; formula, (1, 2,) (3, 4,) 5, 6; 6 longest, 3 and 4 shortest, a few hairs toward tip; marginal spines conspicuous around the head, a prominent one each side of each caudal seta; claws of feet simple, slightly curved inward, accompanied by a few hairs." Original description.

Prof. Bogue then says that the specimens are variable in size, color and markings, so that he thinks it possible that more than one species may be included in the description.

Remarks: First found in Ohio by Prof. J. S. Hine, at Georgesville, Franklin Co., on *Quercus alba*.

GOSSYPARIA SPURIA (Modeer).

Coccus ulmi Geoff. Histoire Abregee des Insectes, 1, 1762, pp. 512-13.

Gossyparia ulmi Howard, Insect Life, ii, 1889, pp. 34-41. 5 figs.

Adult female: Length, 2—2.5 mm., reddish, oval in outline, surrounded by an irregular mass of white wooly secretion, forming a cushion, which at first is in the form of lamellae, but later is more or less fused. The segmentation is fairly distinct and rendered more so by the inward projection of the secretion over each suture. After the birth of the young the female shrivels up and can be easily jarred from the cushion. The antennae are six-jointed, second and third longest, fourth and fifth shortest. The legs are small and slender, the tibia shorter than the tarsus. The ano-genital ring bears eight hairs.

Adult male: There are two forms of the males; one, the first to emerge from the cottony cocoons, is a form with short wing-pads and a large robust body; the other, the full-fledged males appearing later, are delicate two-winged creatures with large heavy, almost moniliform, 10-jointed antennae. The males are not easily disturbed and seldom take flight.

Larvae: The young larvae are easily recognized on leaves and twigs, as small oval specks about 0.5 mm. in length, narrowed posteriorly. Each segment bears laterally a spine, also a ring of six upon the head and a double row on the back. The antennae are six-jointed; joints 1, 2, and 3 the longest. The full-grown male larvae have 7-jointed antennae.

Remarks: This species which is causing alarm in some eastern states is not common in Ohio; in fact, it was reported only last year, (1902), in Columbus, by Mr. A. F. Burgess, Chief State Nursery Inspector.

ERIOCOCCUS AZALEAE Comst.

This Coccid was reported by Prof. Webster, at the Experiment Station at Wooster, on a planted shrub, (*Rhododendron*

catawbiense). Both males and females are early enclosed in a white, dense, felt-like, ovoid sac about 3 mm. long and 1.5 mm. wide. The females when removed from the sac are dark purple, have 6-jointed antennae and an anal ring with eight hairs. The dorsal surface is covered with numerous spines and tubercles.

PHENACOCCLUS ACERICOLA (King).

Pseudococcus aceris Smith, E. A., N. Am. Ent., p. 73 (1880).

Phenacoccus acericola King, Can. Ent., xxxiv, p. 211 (1902).

The adult female is concealed by an irregular cottony mass 6—8 mm. in diameter, on the underside of leaves of hard maple, appearing not unlike the ovisac of a *Pulvinaria*. The female itself is about 5 mm. in length, oval, yellow and plump; the segmentation showing plainly toward the posterior end. The body surface is covered with spinnerets which are more numerous posteriorly; also groups of spines are found on the margin of the body. The widely separated, 9-jointed antennae bear numerous, long, flexible hairs. Formula: 9, (1, 2, 3, 5,) (4, 6,) (7, 8). Mr. King says in his description that later in the fall when the females are well-filled with eggs, they bear 8-jointed antennae, with the following formula: 4, (8, 2,) 3, (1, 5, 6,) 7.

The adult male issues from a white, closely woven, oval cocoon, usually attached under the rough loose bark of the trunk and larger limbs. Two long waxy filaments issue from the eighth and ninth segments. Antennae 10-jointed almost as long as the red body. Wings large, covered with white powder and iridescent in sunlight.

Remarks: The author has found this species on *Acer saccharum* at Columbus, associated with *Aspidiotus comstocki* Johns.

PHENACOCCLUS OSBORNI Sanders.

Plate vii, (lower half).

P. (Paroudablis) osborni Sanders, Ohio Naturalist, Vol. II, No. 8, p. 284, 1902.

Female: (adult), 2 to 2½ mm. in length, 1 to 1¼ mm. in breadth, flesh-colored and covered with a slight, white powdery secretion. There are seventeen very short, inconspicuous, lateral filaments on each side. Although the filaments are short, spinnerets and numerous hairs are scattered over the surface of the body, being especially numerous in the cephalic region. On the anterior ventral margins of the second and third segment, are two large spiracles. The anal lobes, bear each, two long hairs and three short ones, besides the spines. The large, retracted anal ring bears the customary six long hairs, and is conspicuously dotted. The eyes are prominent, though not large. The antennae are nine-jointed. The formula is as follows: (3, 2,) (4, 9, 5,) 1, 8, (6, 7). The legs are well developed and darker in color than the

body; the tibia being nearly three times the length of the tarsi, and bearing a pair of strong spines on the distal end. Numerous hairs are borne by the tarsi but no noticeable digitules. A pair of knobbed digitules is borne by the long single-toothed claws.

The eggs are long-elliptical, golden-brown, rather firm, measuring .3 mm. x .15 mm.

Male (adult) is an active, well-constructed insect; the thorax constituting one-half the length of the individual. Measurements: From tip of head to tip of abdomen, .85 mm.; wing expanse, 2.8 mm. From tip of head to tip of folded wings along dorso-median line, 1.5 mm.; length of wing, 1.25 mm.; width of wing, .55 mm.; length of balancers, .1 mm. Caudal filaments; two about 1.25 mm., and two about 1 mm. in length. Front legs; femur .25 mm., tibia .35 mm., tarsus, .12 mm., claw .03 mm. in length. Hind legs; femur .3 mm., tibia .4 mm., tarsus .13 mm., claw .03 mm. in length. Antennae are 1 mm. in length, the joints measuring; 1st, 45 mm.; 2nd, 60, 3rd, 160, 4th, 150, 5th, 135, 6th, 120, 7th, 96, 8th, 75, 9th, 63, 10th, 90. Formula: 3, 4, 5, 6, 7, 10, 8 (9, 2,) 1.

Color: Head, dark reddish-brown; eyes, blackish; thorax, reddish-brown except dark, chitinous parts; abdomen light-brown tinged with yellow. Antennae, reddish-brown; legs, brown to olivaceous with dark-brown tarsi. Caudal filaments, white; wings, semi-transparent with iridescent rose-tint in strong light. Balancers, darker, slightly chitinous on costal margin, bearing one long, hooked claw which fits into a pocket in the wing.

Although the head is very small and much reduced, and bears four reddish ocelli, the thorax is very large and well developed and bears a black, shield-shaped chitinous plate on the meso-scutum, from which three dark, chitinous bands extend to the anterior margin of the thorax.

The legs are long and hairy for their entire length; the tibia bear a pair of strong spines on their distal extremity; the tarsi are armed with numerous spines; the claws are long and curved, and bear a sharp denticle on the ventral margin, near the tip. Two knobbed digitules are present, extending beyond the tip of the claw.

The males were found emerging from the pupa-cases from April 13 to 18, and taking wing readily.

The females were found, during the winter, under loose bark on the trunks and larger limbs of *Platanus occidentalis* on the campus of Ohio State University, at Columbus. Not abundant.

A Chalcid parasite was reared from specimens collected in February.

Pseudococcus citri (Risso).

(Mealy Bug)

Figs. 46, 47, 48.

Dorthesia citri Risso, Essai, Hist. Nat. des Oranges (1813).*Dactylopius citri* Sign., Ann. Soc. Ent. Fr., (5) v, p. 312 (1875).*Dactylopius destructor* Comst., Rep. U. S. Dep. Ag., 1880, p. 342 (1881).

Adult female: Length 3.5—4 mm., width 2—2.5 mm., white or yellow with brownish tinge, darker than *P. longispinus*, and with less powdery secretions covering body. The seventeen lateral appendages are short and blunt; posterior appendages not much longer than lateral ones. Antennae 8-jointed, less pubescent than in *P. longispinus*; formula: 832 (17) (564). The penultimate segment bears on either side a very long seta, and two or three very short ones, and two conical projections, the surface of the segment is dotted with orifices. Six slender setae, one-half the length of the setae on the penultimate, are borne by the ano-genital ring, which is somewhat projected from the penultimate segment.

Remarks: This species differs from *P. longispinus* by the absence of the long filaments at the posterior end of the body. The female is oviparous, laying her eggs in a cottony sac, which increases in size with the growth of the adult female.

Pseudococcus longispinus (Targ.).

Figs. 49, 50, 51.

Coccus adonidum corpore roseo, etc., Geoff., Abr. Ins., i, p. 511 (1762).*Dactylopius longispinus* Targ., Catalogue, p. 32 (1869).*Dactylopius adonidum* Comst., Rep. U. S. Dep. Ag., 1880, p. 341 (1881).

Female: Length, 2.5—3 mm., width, 1.5—2 mm. White or tinged with yellow, with brown band on middle of back; each segment with a white waxy filament, which forms a border of appendages of varying lengths around the body; those near the posterior extremity longer, and four at caudal end very long, the inner the longer, sometimes longer than body. Entire body appears as if dusted with flour, which is caused by the waxy secretion. Antennae 8-jointed, each joint bearing several hairs. Formula: 8, (2, 3,) (1, 5,) (4, 6,) 7. The legs are long, stouter than in *P. citri*, somewhat pubescent; tibia twice as long as tarsus. The penultimate segment presents on either side a rounded group of pores and two short, strong spines, also a seta somewhat longer than the anal setae, and several shorter setae. Anal ring large, dotted, with six long setae.

Larvae: The male and female larvae are similar to adult female in shape and color, but the male larva has 7-jointed and the female 6-jointed antennae.

Remarks: This is a pest in almost every conservatory, and is difficult to control since the waxy secretion protects it from a spray of water, and only by a spray of considerable force can it be dislodged.

Pseudococcus pseudonipae (Ckll.)

Dactylopius nipae Davis, Spec. Bull. 2, Mich. Exp. Sta., p. 28 (1896).

Dactylopius pseudonipae Ckll., Science Gossip, N. S., iii, pp. 189, 302 (1897).

Dactylopius pseudonipae King, Can. Ent., xxxi, p. 112 (1899).

The author found this peculiar *Pseudococcus* on palms in a greenhouse at Painesville, where it was quite a pest.

PSEUDOCOCCUS TRIFOLII (Forbes).

Figs. 52, 53, 54.

Coccus trifolii Forbes, 14th Rep. Ins. Ill., p. 72 (1885).

Dactylopius trifolii Osborn, Contr. Ia. Ag. Coll. p. 2 (1898).

Dactylopius trifolii Davis, Bull. 116, Mich. Exp. Sta., p. 58 (1894).

Adult female: 2—2.3 mm. in length, reddish-brown, covered with granular, waxy secretion. A fringe of seventeen waxy processes extends around the body, longer at caudal end, sometimes one-third the length of the body. The legs are dirty yellow in color, femur and tibia subequal, tarsus of hind leg more than one-half the length of the tibia. Four digitules, the two superior ones long and slender, two inferior stouter and knobbed at tip. Antennae 8-jointed; joint one swollen, stout, as broad as long. Formula: 8 (321) 5 (467). The fourth joint varies considerably, sometimes smaller, sometimes larger than 5, 6, or 7. Anal lobe bears one long and three short setae, and a mass of small gland-spots with two conical projections. Ano-genital ring large, dotted, with six long setae, about same length as anal lobe setae. Penultimate segment conspicuously dotted with gland orifices.

Remarks: On roots of clover at Columbus, O., not plentiful.

Subfamily COCCINAE.

This group which belongs here in order of arrangement, has been omitted in this paper, with the expectation of a later account. Lack of material and literature have been the main factors in the omission of this group.

Genus CHIONASPIS Signoret.

This genus was founded in 1869 by Signoret, in the Annals of the Entomological Society of France. In 1897 the group was divided, and in Ohio is reported a single greenhouse representative of the genus *Hemichionaspis* Ckll.

- I. Scale of male oval, without carinae,
 Scale of female 2—2.5 mm. in length; fifth group of
 gland-spines with more than four ortholobis
 Scale of female smaller, 1.5—2 mm. in length; fifth
 group of gland-spines numbering less than four longiloba
- II. Scale of male carinated more or less distinctly, narrow,
 - A. Median lobes more or less fused,
 - B. Median lobes fused to near tips, notched on outer margin
americana
 - BB. Median lobes fused half-way on inner margins,
 - C. Lobes broad, entire, close together caryae
 Median lobes similar to *caryae*, but serrate on margin;
 outer lobule of second lobe, triangular, acute sylvatica
 Lobes narrower, pointed, second distant from median
 by half its width gleditsiae
 - AA. Median lobes not fused by inner margins, perhaps
 approximate,
 - D. Fifth group of gland-spines from 1-3 pinifoliae
 - DD. Fifth group of gland-spines from 3-11
 - E. Median lobes broadly rounded,
 - F. Lobules of second and third lobes decidedly rounded
salicis-nigrae
 - FF. Lobules of second and third lobes obliquely pointed furfura
 - EE. Median lobes obscurely pointed, short, divergent corni
 - EEE. Median lobes and lobules of second and third lobes
 pointed and striate euonymi

CHIONASPIS AMERICANA Johnson.

Fig. 31.

Ch. americana Johns., Ent. News, vii, p. 150 (1896).

Ch. americana Johns., Bull. Ill. St. Lab. N. H., iv, p. 390 (1896).

Ch. americana Cooley, Spec. Bull. Mass. Exp. Sta., p. 41 (1899).

Scale of female: Length 2—3 mm. Plainly convex, broadest near the middle, of firm texture, white sometimes with yellowish tinge, but usually blackened by a sooty substance which renders it very inconspicuous. The exuviae are about 0.7 mm. long. A conspicuous white mark is left when removed from bark.

Scale of male: Length 0.7—1 mm. Sides parallel, tri-carinate. Exuvia pale-yellow.

Female: The median lobes are fused nearly to the apex, notched on lateral margin, rounded. Inner lobule of second lobe converging, notched once or twice on lateral margin; outer lobule short, rounded, usually entire. Third lobe broad and flat, scarcely divided, sometimes serrate. A club-shaped process extends anteriorly from between median lobes, also processes at inner margins of second and third lobes. The gland-spines are arranged as follows: 1, 1-2, 2, 2-4, 5-7. Those in the second and third groups are frequently forked at the tip. Second row of dorsal pores absent; third row with 4-6 in the anterior and 4-5 in the posterior group; fourth row with 4-5 in anterior and 4-6 in posterior group. Median group of circumgenital gland-orifices, 20-30; anterior lateral, 18-42; posterior lateral, 20-30.

Remarks: This native species is very common in Ohio on *Ulmus americana*, and is pretty generally distributed, almost attaining economic importance. Each female lays about seventy-five purplish, ellipsoidal eggs, in which stage the insect passes the winter, hatching about the middle of May. In this latitude there are two broods.

CHIONASPIS CARYAE Cooley.

Fig. 29.

Ch. caryae Cooley, Can. Entomologist, Vol. xxx, p. 86 (1898).

Ch. caryae Cooley, Special Bull. Mass. Exp. Sta., p. 40 (1899).

Scale of female: Length, 1.7—2 mm. Dirty white, inconspicuous on bark of host; texture thick; form irregular and rather convex. Exuviae dark-brown, 0.7 mm. long. The first exuviae is easily seen, but the second is somewhat covered by secretion.

Scale of male: Length, 0.5—0.7 mm. Oblong to elliptical with distinct median carina. The pale-brown exuvia occupies nearly one-third of the scale.

Female: Median lobes large, broad, entire, striate, diverging; the inner margins fused half-way to the apex, and a club-shaped chitinous process extending anteriorly. Inner lobules of second and third lobes, much the larger and serrate; the outer lobule of third lobe often obscure or obsolete. The gland-spines are arranged as follows: 1, 1, 1, 1-2, 4-7. The first pair are short and blunt. The second row of dorsal pores represented only by the anterior group of 1-4; third row, 4-5 in anterior and 3-5 in posterior group; fourth row with 4-6 in anterior and 4-5 in posterior group. Median group of circumgenital gland-orifices, 10-18; anterior lateral, 20-29; posterior lateral, 15-22.

Remarks: Collected by the author on Catawba Island, Ottawa Co., July 10, 1902; the first report of its occurrence in the state. Several small white hickory trees (*Hicoria alba*), were

rather badly infested, causing malformation of the smaller branches and twigs.

CHIONASPIS CORNI Cooley.

Figs. 26, 27.

Chionaspis corni Cooley, Special Bull. Hatch Exp. Sta., p. 15 (1899).

Chionaspis corni King, Can. Ent., xxxiv, p. 61 (1902).

Scale of female: Length, 1.6—2 mm. Somewhat irregular in shape, gradually broadened posteriorly, of rather delicate texture, white. The orange-yellow or brown exuviae are about .7 mm. long.

Scale of male: Length, .6—.8 mm.; the pale-yellow exuvia occupies about one-third of the moderately tri-carinate scale.

Female: Median lobes fused for about one-half their length, then they diverge in an almost straight edge to the somewhat pointed apex; usually entire, short and broad. Inner lobule of second and third lobes rounded, entire and much larger than outer lobule. Gland-spines, excepting first, rather long and slender, arranged as follows: 1, 1, 1-2, 1-2, 4-6. Second row of dorsal pores represented by anterior group of 2-5; third row with 4-5 in anterior and 5-7 in posterior group; fourth row with 4-7 in anterior and 6-9 in posterior group. Median group of circumgenital gland-orifices, 9-16; anterior lateral, 17-28; posterior lateral, 10-20.

Remarks: This species was first collected in Ohio, at Sandusky on *Cornus amomum*, by Prof. Herbert Osborn and later by the author. The smaller branches were encrusted with the scales.

CHIONASPIS EUONYMI Comst.

Fig. 28.

Ch. euonymi Comst., Rep. U. S. Dep. Ag., 1880, p. 313 (1881) in part.

Ch. euonymi Kuwana, Pr. Cal. Ac. Sci., (3) iii, p. 75 (1902).

Scale of female: Length about 2 mm., decidedly broadened posteriorly, convex, rather thick and firm in texture, dark grayish-brown. Ventral scale entirely developed, attached along the sides but free at the posterior extremity.

Scale of male: Length, 1.5 mm., white, tricarinated with a yellow exuvia.

Female: Median lobes, and lobules of second and third lobes, serrulate and pointed. The lobes are far apart, and the lobules are distinctly parted to the base, slightly chitinized on the margins, the inner always the larger. Gland-spines rather short, and arranged as follows: 1, 1-2, 1-2, 1-3, 1-4. On the ventral margin the spines are short and inconspicuous, situated near each group of gland-spines excepting the fifth. The dorsal spines are longer and situated mesad of the corresponding ventral spine. Dorsal pores rather numerous and

promiscuously arranged. Five groups of circumgenital gland-orifices; median, 4-6; anterior lateral, 5-9; posterior lateral, about 4.

Remarks: This species was originally described on *Euonymus latifolia*, at Norfolk, W. Va. It was reported on *Althea*, sp. at Cincinnati, Ohio.

CHIONASPIS FURFURA (Fitch).

Fig. 30.

Aspidiotus furfurus Fitch, 3rd. Rep. Ins. N. Y., p. 352 (1856).

Chionaspis furfurus Lint., 1st. Rep. Ins. N. Y., p. 331 (1882).

Chionaspis furfurus (Fitch) Comst. Rep. U. S. Dep. Ag. 1880, p. 315 (1881).

Chionaspis furfura Cooley, Spec. Bull. Mass. Exp. Sta., p. 23 (1899).

Scale of female: Length, 2—2.5 mm. Grayish or snow-white, very broad posteriorly, flat, thin and delicate, often bent to left or right from the small, yellowish-brown exuviae. Irregular when massed.

Scale of male: Length, 0.7—1 mm. Distinctly tri-carinate, roughened above. Exuvia pale-yellow, covering about one-third of the scale.

Female: Three pairs of striate lobes; median pair short, broad, rounded, entire, with two oblique, chitinous bars at their bases; second pair usually entire, somewhat truncate, inner lobule the larger, oblique with inner edge thickened; third pair serrate, sometimes prominent, but usually rudimentary. The gland-spines are arranged as follows: 1, 1, 1, 1, 4-9; the first is small or wanting. Second row of dorsal pores absent; third row with 2-4 in anterior and 3-5 in posterior group. Five groups of circumgenital gland-orifices; median, 7-16; anterior lateral, 22-32; posterior lateral, 16-22.

Remarks: This is the most common species of the genus *Chionaspis* in the United States. It can be found upon *Apple* and *Pear* trees in greater or less quantity in almost any locality examined. It rarely becomes a serious pest in Ohio, because the lady-bird beetle *Chilocorus bivulnerus* is predaceous upon it, and usually precludes the necessity of resorting to remedial measures.

CHIONASPIS GLEDITSIAE Sanders.

Figs. 36, 37.

Ch. gleditsiae Sanders, Ohio Naturalist, Vol. III, No. 6, p. 413 (1902).

Scale of female: Length, 1.5—2 mm. Irregular in form, usually very broad posteriorly, somewhat convex. Of rather firm texture, dirty-white, usually blackened and inconspicuous on host. When removed, a conspicuous white patch is left.

Scale of male: Length, .6—.8 mm. Sides parallel, strongly carinated. Exuvia pale-yellow, occupying about one-fourth of the scale.

Female: Broadest toward posterior end, segments prominent. Median lobes broad at base, tapering sharply and serrate. The mesal margins approach at base and apparently fuse, forming a small, club-shaped thickening extending anteriorly. Inner lobule of second lobe very long and narrow, extending posteriorly two-thirds of length of median lobe, and separated from it by almost its own width. Outer lobule rudimentary, rounded. Third lobe rudimentary; lobules faintly serrate. The gland spines are arranged as follows: 1, 1, 1, 1. 3-4; large and conspicuous, decreasing in size toward the median lobes. Spines on the dorsal surface are arranged as follows: first on base of median lobe, lateral of center; second at base of second lobe, between the lobules; third at base of third lobe; fourth about two-thirds of distance to penultimate segment, posterior from the fourth gland-spine. On the ventral surface, the spines are shorter and located just laterad of the corresponding spine. First and second rows of dorsal pores are absent; third row represented by 3-5 in the anterior and 3-6 in the posterior group; fourth row by 2-4 in the anterior and 5-7 in the posterior group. Median group of circumgenital gland-orifices, 4-10; anterior lateral, 15-21; posterior lateral, 8-14.

Remarks: Abundant on *Gleditsia triacanthos* (Honeylocust) at Columbus; also found at Newark, Westerville and Cedar Point.

CHIONASPIS LONGILOBA Cooley.

Ch. longiloba Cooley, Spec. Bull. Mass. Exp. Sta., p. 16 (1899).

Scale of female: 1.5—2 mm. in length, white or dirty-white in color; texture moderately strong, not unlike *Ch. salicis-nigrae*. Exuviae, light-brown to dull yellow; about .8 mm. long.

Scale of male: Small, .6—.8 mm. long, oval and without carinae; exuvia, delicate light-brown or colorless.

Female: Median lobes and inner lobule of second lobe long and conspicuous. Median lobes obscurely pointed, serrate, slightly divergent with small chitinous thickenings at inner bases. Inner lobule of second and third lobes, serrate, larger than the outer and more pointed than in ortholobis. Inner margin of second lobes bear a small narrow chitinous process; third lobe very oblique. The gland-spines are arranged as follows: 1, 1-2, 1-2, 1-2, 2-3; decreasing rapidly in size toward the meson. Spines are arranged on each surface as follows: first at outer base of median lobes; second and third at bases of outer lobules of second and third lobes respectively; fourth about two-thirds of distance to penultimate segment. The ventral spines are in each case smaller and shorter, and located just laterad of each corresponding dorsal spine. Second row of dorsal pores with only the anterior group of 3-5; third row with 5-7 in the anterior and 4-5 in the posterior group; fourth row with 5-6 in the anterior and 5-7 in the posterior

group. Median group of circumgenital gland-orifices, 10-21; anterior lateral, 20-35; posterior lateral, 10-24.

Remarks: Found on Cottonwood at Painesville, Lake Co., O., by Mr. G. A. Runner, one of the State Nursery and Orchard Inspectors. The lobes of *Ch. longiloba* are longer than in any other species except *gleditsiae*, but the latter can easily be distinguished by the fused median lobes and the wide separation from them of the second lobes. In the Ohio specimens the circumgenital gland-orifices are more numerous than in those originally described; median group, 14-21; anterior lateral, 24-35; posterior lateral, 14-24. In most cases the dorsal pores were more numerous than in the original.

CHIONASPIS ORTHOLOBIS Comst.

Ch. ortholobis Comst., Rep. U. S. Dep. Ag., 1880, p. 317 (1881).

Ch. ortholobis Cooley, Spec. Bull. Mass. Exp. Sta., p. 17 (1899).

Ch. ortholobis Newell, Bull. 43, Ia. Exp. Sta., p. 154 (1899).

Ch. ortholobis Hunter, Kan. Univ. Quar., ix, p. 101 (1900).

Scale of female: Longer than *Ch. longiloba*, 2—2.5 mm.; broadly oval, slightly elongated, usually regular; white to dirty-white. Exuviae, 8 mm. long, brown and more noticeable than that of *longiloba*.

Scale of male: Similar to that of *Ch. longiloba*.

Female: Median lobes close, parallel half-way on inner margins, then each lobe narrows similarly from each side to an obtuse point, or rounded. Inner lobules of second and third lobes rounded, larger than outer lobules and oblique. The gland-spines are arranged as follows: 1, 1-2, 1-2, 2, 4-5, shorter than in *longiloba*. The spines are arranged as in the latter. Second row of dorsal pores represented by the anterior group of 4-7; third row with 7-9 in anterior and 5-8 in posterior group; fourth row with 9-11 in anterior and 5-9 in posterior group. Median group of circumgenital gland-orifices, 10-25; anterior lateral, 18-35; posterior lateral, 16-24. They are quite variable in the same specimen.

Remarks: Found by the author on Cottonwood at Newark, O. This species also occurs on willow, poplar and butternut. The median lobes are parallel in general direction and so close along the basal half, as to appear fused. There is a relationship indicated between *Ch. longiloba* and *Ch. ortholobis* in the absence of carinae on the male scale. This feature distinguishes these two species from all other known species, except that *Ch. platani* is very feebly unicarinate or the carinae are sometimes wanting.

CHIONASPIS PINIFOLIAE (Fitch).

Figs. 34, 35.

Aspidiotus pinifoliae Fitch, 2nd Rep. Ins. N. Y., p. 488 (1855).*Chionaspis pinifoliae* Comst., Rep. U. S. Dep. Ag. 1880, p. 318 (1881)*Chionaspis pinifolia* Cooley, Spec. Bull. Mass. Exp. Sta., p. 30 (1899).

Scale of female: Snow-white with bright orange or brown exuviae, shape depending upon width of leaf of host, but usually broadened posteriorly and very convex. Length, 3—4 mm.; length of exuviae about 1 mm.

Scale of male: Length, 1—1.3 mm. The pale yellow exuvia occupies about one-third the length of the tri-carinate, posteriorly broadened scale.

Female: Three pairs of thin, striate, well-developed lobes; the median almost circular in outline, entire, separated by about one-third their width, slightly diverging at the apex and joined anteriorly by an arched chitinous process. Inner lobule of second and third lobes, the larger and subtruncate. The gland-spines are arranged as follows: 1, 1, 1, 1, 1-3, becoming shorter toward median lobes. The spines on the ventral surface are short and inconspicuous, situated one mesad the base of the first, second, third and fourth gland-spines respectively. Those on the dorsal surface are longer and situated mesad of the corresponding ventral spine. Second row of dorsal pores represented by anterior group of 2-4; third row by 3-5 in anterior and 4-6 in posterior group; fourth row by 3-7 in anterior and 5-8 in posterior group. Median group of circumgenital gland-orifices, 7-13; anterior lateral, 12-20; posterior lateral, 14-18. The eggs are purplish, ellipsoidal; length 0.25 mm.

Remarks: Native on various pines and spruces of the United States, especially in the states east of the Mississippi River. Many trees on the Ohio State University Campus are badly infested, appearing at a distance as if dusted with flour.

CHIONASPIS SALICIS-NIGRAE (Walsh).

Figs. 32, 33, 74.

Aspidiotus salicis-nigrae Walsh., 1st Rep. Nox. Insects Ill., p. 39 (1868).

Chionaspis salicis Comst., Rep. U. S. Dep. Ag., 1880, p. 320 (1881).

Chionaspis salicis-nigrae Cooley, Spec. Bull. Mass. Exp. Sta., p. 19 (1899).

Scale of female: Length, 2.5—4 mm., broadest near middle, distinctly convex, snow-white. Exuviae .8—.9 mm. long, yellowish-brown, sometimes almost colorless.

Scale of male: Length, 1—1.2 mm. Slightly broadened posteriorly, with posterior end rounded; feebly tricarinate. Exuvia varying from brown to almost colorless.

Female: Median lobes broad, short, rounded, entire or serrulate. Inner lobule of second and third pairs larger than outer, sometimes serrulate. The gland-spines are arranged as follows: 1, 1-2, 1-2, 1-3, 4-6. In this species there are two kinds of dorsal pores. Accompanying the anterior groups are smaller circular pores, also grouped. Oval dorsal pores; third row with 6-9 in anterior and 5-8 in posterior group; fourth row with 6-10 in anterior and 7-10 in posterior group. Median group of circumgenital gland-orifices, 21-36; anterior lateral, 31-45; posterior lateral, 28-32.

Remarks: The Willows (*Salix*) are the usual hosts of this species, although it is reported from *Liriodendron tulipifera*, *Populus* sp., *Amelanchier canadensis*, and two species of *Cornus*. About 75 reddish-purple eggs are to be found under a scale during the winter, which hatch about the first of June.

CHIONASPIS SYLVATICA Sanders.

Figs. 64, 65.

Ch. sylvatica Sanders, Ohio Naturalist, IV, 4, p. 95 (1904).

Scale of female: Length, 1.5—2 mm., somewhat convex, very irregular in shape, sometimes elongated and rounded posteriorly, and sometimes decidedly broadened and truncate posteriorly, giving it a deltoid shape; dirty-white to light-buff. First exuvia persistent, buff; second exuvia brown.

Scale of male: Length .6—1 mm., white, strongly tri-carinate with parallel sides. Exuvia very small, delicate, semi-transparent covering about one-fifth of the scale. Commonly found on the leaves of its host.

Female: Oval in outline, with third, fourth and fifth lobes anterior from the pygidium prominent. Median lobes fused to near the tip, diverging widely to rounded tips, then truncated obliquely toward the second lobes; serrate or crenulate on lateral margins. Inner lobule of second lobe serrate, produced on inner margin to a rounded tip; outer lobule reduced, triangular, sharp-pointed, entire. Third lobe slightly produced, serrate. On median line, a chitinous band extends anteriorly to base of median lobes, expanding to a bulb-like thickening. Chitinous bands extend obliquely toward this from outer margins. Second lobes slightly thickened on inner margins. The gland-spines are arranged as follows: 1, 1, 1, 1-2, 4-6, the first short and blunt. Second row of dorsal pores represented by 1-2 in anterior group; third row by 3-4 in anterior and 4-5 in posterior group; fourth row by 3-4 in anterior and 5-7 in posterior group. Median group of circumgenital gland-orifices, 7-10; anterior lateral, 15-20; posterior lateral, 14-18.

Remarks: This scale has been found on *Nyssa sylvatica*, at four widely separated locations in Southeastern Ohio; Sugar

Grove, Fairfield Co., Newark, Licking Co., Somerset, Perry Co., Quaker City, Guernsey Co.

Howardia biclavis (Comst.)

Fig. 39.

Chionaspis (?) *biclavis* Comst., 2nd Rep. Dep. Ent. Corn. Univ., p. 98 (1883).

Howardia biclavis Berl. e Leon., Riv. Pat. Veg., iv, p. 348 (1896).

Scale of female: Circular, convex, 2 mm. broad, white, variously colored by epidermis of host plant under which it mines. Exuviae marginal, the first projecting beyond the margin of the scale.

Female: Median lobes large, broader than long, approximate at base, somewhat pointed, lateral margins serrate, mesal margins diverging; second lobe small, pointed, simply a projection of the segment; third lobe rudimentary, low serrate; fourth lobe broad, low, incised forming two pointed serrate lobules. Plates simple, spine-like, increasing in size from the meson; two small ones between median lobes, two between first and second, usually three between second and third, four or five between third and fourth lobes, and laterad of fourth lobes six or seven larger plates. Spines accompany each group of plates on both dorsal and ventral surfaces. Dorsal pores rather numerous, very small, in three interrupted rows. Circumgenital gland-orifices wanting. On the ventral surface accompanying each group of plates, is a group of very small spines. Extending anteriorly within the body wall, from the median lobes, are two long, club-shaped, chitinous thickenings, which are characteristic of this species. Anal orifice situated far anteriorly, just anterior of the genital orifice.

Remarks: This Coccid was found badly infesting *Hibiscus aculeatus* in the Ohio State University Conservatory. It has a peculiar habit of mining under the epidermis of the host plant and maturing there.

Diaspis boisduvalii (Signoret).

Fig. 42.

Diaspis boisduvalii Sign., Ann. Soc. Ent. Fr., (4), ix, p. 432 (1869).

Diaspis boisduvalii Comst., 2nd Rep. Dep. Ent. Corn. Univ. p. 86 (1883).

Scale of female: 2 mm. diam., circular, sometimes a little elongated, white or light-gray. Very large exuviae slightly darker in color, nearly central.

Scale of male: White, strongly tri-carinated, usually massed in large numbers and covered with white, wooly hairs.

Female: Cephalo-lateral angle of body is prolonged into a small projection. Median lobes are large, wing-shaped, divergent, separated at base, serrate on mesal margins, and attached for entire length of

lateral margins to the segment. Lobules of second, third and fourth lobes, subequal; the outer usually lower and broader. Fourth lobe obscure and serrate. There is a gland-spine, located just laterad of the first, second, third and fourth lobe respectively, and laterad of the fourth lobe at subequal distances are 4-6 tubular gland-spines. Between the fifth and sixth gland-spines is a dark-colored, pointed projection of the body wall. The first pair of spines on the ventral surface project caudad between the median lobes; the second and third mesad of the second and third gland-spines; the fourth between the fourth and fifth, and the fifth spine between the seventh and eighth gland-spines respectively. On the dorsal surface, a small spine at apex of median lobe; second and third spines on lateral lobule of second and third lobes respectively; fourth mesad of fourth gland-spine; fifth between sixth and seventh plates. Groups of circumgenital gland-orifices distinct, elliptical in outline; median, 8-16; anterior lateral, 20-28; posterior lateral, 15-18.

Remarks: In greenhouses on Palms, Orchids, *Maranta*, etc.

Diaspis bromeliae (Kerner).

This species, which is a great pest where pineapples are grown, has been reported at Columbus by Prof. E. E. Bogue. It is similar to *Diaspis boisduvalii* except that the smaller median lobes project beyond the margin of the segment; i. e., they are partly free, while in the latter the median lobes are adnate, along the entire side, to the segment.

Diaspis echinocacti cacti Comst.

Figs. 43, 76.

Diaspis cacti Comst., 2nd Rep. Dep. Ent. Corn. Univ. p. 91 (1883).

Diaspis cacti Ckll., Can. Ent., xxv, p. 127 (1894).

Diaspis cacti Osborn, Contr. Ia. Ag. Coll., p. 5 (1898).

Scale of female: Nearly circular, 1.5—1.7 mm. in diam., white to light-gray; exuviae central or subcentral, dark brown.

Scale of male: White, unicarinated; exuvia yellowish to brownish.

Female: Four pairs of small lobes; the mesal with entire margins, apparently extending into the segment, widest near middle, diverge suddenly to a rounded apex. Lobules of second, third and fourth lobes, subequal, parallel and subtruncate. Plates and spines similar to those of *Diaspis boisduvalii*. Median group of circumgenital gland-orifices, 6-13; anterior lateral, 16-22; posterior lateral, 12-18.

Remarks: Found in Ohio State University Conservatory—badly infesting a night-blooming *Cereus*.

Aulacaspis pentagona (Targ.)

This species was introduced at Wooster on a double flowering cherry from Japan, but did not survive the winter of 1898-99. (Webster.)

AULACASPIS ROSAE (Bouche).

Figs. 44, 45.

Aspidiotus rosa e Bouche, Naturg. Ins., p. 14 (1834).

Diaspis rosae Comst., Rep. U. S. Dep. Ag., 1880 p. 312 (1881).

Aulacaspis rosae Ckll., Bull. Bot. Dept. Jam., p. 259 (1896).

Scale of female: Circular or irregular, snowy-white, sometimes with yellowish tinge, 2-3 mm. diam; exuviae sublateral; first larval skin naked showing the segmentation; second covered.

Scale of male: 1.25—1.5 mm. in length; white and tri-carinated.

Female: Body elongated; the ante-penultimate segment prominently lobed and bearing 8-10 gland-spines. Median lobes large, approximate at base, serrulate, diverging, attached to body for entire length. Inner lobules of second, third and fourth lobes, rounded larger than the outer lobule. Fourth lobe nearly obsolete. There is a gland-spine laterad of each of the four lobes and 2-4 near penultimate segment, enlarging as they are further removed from the meson. On the dorsal surface the spines are situated as follows: a very small one on the median lobe, and one slightly larger on the outer lobule of the second, third and fourth lobes respectively, and one about three-fourths of distance to penultimate segment. The spines on the ventral surface are slightly mesad of the corresponding dorsal ones. Dorsal pores in three rows; second row represented by anterior group of 2-3; third row, anterior group, 4-5, posterior group, 5-6; fourth row, anterior, 4-6, posterior group, 6-8. Mesad of second and third lobes respectively, is an elongated pore appearing like a lobe. Anterior group of circumgenital gland-orifices distinct, rounded, 18-22; anterior lateral, 25-32; posterior lateral, 26-34. Lateral groups indistinctly separated, sometimes almost continuous.

Remarks: Generally distributed over Ohio on rose-bushes, raspberries and blackberries.

Genus HEMICHIONASPIS Ckll.

In the members of this genus the median lobes are fused, and together form a dark-colored semi-circle. But one species has been reported, *H. aspidistrae* Sign. in which the scale of the female is brown and the median lobes are small and sunken in the pygidium.

Hemichionasipis aspidistrae (Signoret).

Fig. 38.

Chionaspis aspidistrae Sign. Ann. Soc. Ent. Fr. (4), ix, p. 443 (1869).

Chionaspis latus Psyche, vii, Suppl., i, p. 21 (1896).

H. aspidistrae Cooley, Spl. Bull. Mass. Exp. Sta., p. 45 (1899).

Scale of female: Length, 1.8—2.5 mm. Decidedly broadened posteriorly, rather strong in texture, yellowish-brown or brown. Exuviae concolorous with the scale but brighter.

Scale of male: Distinctly tri-carinated, 1—1.3 mm. in length. Exuvia bright yellow.

Female: Long, broadest near the middle; the four segments anterior to the pygidium are produced laterally almost into protuberances, at least very conspicuous. Two pairs of well-developed lobes, third pair rudimentary. Median lobes two or three-notched on outer margin; the two lobes forming a semi-circle and a chitinous club-shaped thickening extending anteriorly, all much darker than the other lobes. The second lobe is widely separated from the median by a prominence bearing a marginal gland-orifice. Lobules of second lobe long and spatulate, the inner the longer and with thickened margins at the base. The gland-spines are arranged as follows: 1, 1, 1, 1, 2-4. Second row of dorsal pores and anterior groups of third and fourth rows absent; posterior groups of third and fourth rows with 2-5 each. Median group of circumgenital gland-orifices, 5-15; anterior lateral, 14-22; posterior lateral, 15-23.

Remarks: This species can be easily distinguished from *H. theae* (Mask.) by comparing the broad, ovate exuvia of *H. aspidistrae* with the narrowly elliptical exuvia of *H. theae*. Found on Shield Fern (*Cyrtomium falcatum*) in the Ohio State University Conservatory.

Fiorinia floriniae (Targ.)

Fig. 21.

Diaspis florinia Targ., Studii sub. Cocc., p. 14 (1867)

Fiorinia carnettiae Comst., Rep. U. S. Dep. Ag., 1880, p. 329 (1881).

Fiorinia floriniae Ckll., Ent. Mon. Mag., xxix, p. 39 (1893).

Scale of female: Yellowish-brown, with first exuvia yellow, and remainder of scale a white thin margin. There is a central, longitudinal, dark-brown ridge, and sloping parallel sides more or less wrinkled.

Scale of male: Similar to scale of female but smaller.

Female: Two pairs of lobes. The caudal extremity of the segment is deeply notched, the median lobes are borne by the margins of this notch; they are confluent at base but widely divergent at apex. The second lobe is deeply incised, the mesal lobule the larger. The

gland-spines are long, simple, tapering; one laterad of each lobe and one on the margin of the segment toward the penultimate segment. Between the median lobes are two spines, neither dorsal or ventral. On the dorsal surface two spines are situated along the lateral margin of median lobes, the posterior one the larger, one on outer lobule of second lobe, one one-third and one two-thirds of distance to the penultimate segment; on the ventral surface there is a spine situated laterad of each corresponding dorsal spine, except on the first lobe. There is an elongated pore laterad of each lobe, one half-way and one near to penultimate segment. Five groups of circumgenital gland-orifices, the median continuous with the anterior laterals. Median about 9; anterior lateral, 9-12, in partly double row; posterior lateral, 12-16 arranged in double row. Anal orifice far removed from margin, anterior of the genital orifice nearly as far as median group of circumgenital gland-orifices.

Remarks: Badly infesting a *Kentia* Palm in the Ohio State University Conservatory. Excepting the median ridge, this scale is very flat, brownish, and oblong with parallel sides.

Genus ASPIDIOTUS Bouche.

- A. Median lobes rather large; second and third usually small or rudimentary; plates small, spine-like; margin with two pairs of incisions bounded by thickened chitinous processes Diaspidiotus
- B. Median lobes large and well-developed; second and third reduced or wanting; plates conspicuous, deeply furcate and crowded toward median lobes; margins of incisions thickened Hemiberlesia
- AA. Neither elongated thickenings nor incisions with thickened edges present Aspidiotus s. str.

Subgenus ASPIDIOTUS s. str. (Type, *A. hederæ* Vall.)

This subgenus is characterized by the absence of chitinous thickenings and incisions with thickened margins in the last segment of the female. The plates are well developed and strongly fringed. The scale is light colored and the exuviae are naked. There appear to be no native American species representing this subgenus. From Ohio two greenhouse species are reported.

- A. Median lobes very large, broad, notched on each margin near apex and rounded; second and third lobes scarcely one-third of width of median lobes cyanophylli
- AA. Median lobes a little larger than second lobes and apparently extending into the segment; five to eight branched and simple plates outside of third lobe hederæ

Subgenus *HEMIBERLESIA* Ckll. (Type, *A. rapax* Comst.)

Referring to *Hemiberlesia* Prof. Cockerell says in Bull. U. S. Dep. Ag., t. s. No. 6.;—"This subgenus really represents a southern modification of *Diaspidiotus*, with a convex scale and large median lobes, the others being suppressed. It appears to be exclusively American, and belongs to the tropical and Lower Austral regions, except that one species (*A. convexus*) occurs in the upper Sonoran, and another (*A. ulmi*) in the corresponding zone in Illinois." Four species are reported for Ohio, *A. ulmi* being the only native species.

- A. Groups of circumgenital gland-orifices present,
- B. Plates long and complex; first and second plates from median lobes wide and multi-branched; third, fourth and fifth narrower and simpler. Two incisions in margin of segment cydoniae crawii
- BB. Two or three plate-like extensions of the segment outside of incisions; a small incision laterad of second incision lataniae
- AA. Groups of circumgenital gland-orifices absent,
- C. Median lobes broad, notched on inner and outer margins; inner chitinous process of first incision very long and clavate; plates long and spine-like ulmi
- CC. Median lobes sharply notched near apex; plates toothed and branched, chitinous processes subequal rapax

Subgenus *DIASPIDIOTUS* (Berl. & Leon.) (Type *A. ancylus* Putn.)

The members of this subgenus belong to the North temperate zone, occurring mostly on deciduous trees. The scale is usually dark-colored and the exuviae are covered with secretion. The median lobes are approximate and the margins of the incisions are thickened. In Ohio, eight species of this subgenus are reported.

- A. Posterior segment of female with short, simple, inconspicuous plates.
- B. With second lobe rudimentary or wanting, orange exuviae ancylus
With second lobe rudimentary, orange, exuviae covered with black secretion piceus
- BB. Second lobe slightly developed uvae
- BBB. Inner lobe of second lobe decidedly developed.
- C. Median lobes of medium length, usually notched on outer margin.

- D. Median lobes converging; inner chitinous processes of first incision, bent or club-shaped forbesi
- DD. Median lobes about parallel; processes subequal.
- E. Circumgenital gland-orifices absent perniciosus
- EE. Circumgenital gland-orifices present.
- F. Chitinous processes of first incisions long ostreaeformis
- CC. Median lobes short and broad, almost truncate, very close, and with second and third lobes forming a semi-circle; dorsal pores very numerous in four distinct rows glanduliferus
- CCC. Median lobes short and broad, scarcely notched on outer margin; lobes not forming a semi-circle; dorsal pores less numerous juglans-regiae
- AA. Plates complex, conspicuous; a toothed semi-circular plate between second and third lobes; second lobes often longer than median comstocki

ASPIDIOTUS ANCYLUS Putnam.

Fig. 5.

Diaspis ancylus Putnam, Trans. Ia. Hort. Soc. xii, p. 381 (1877).

Aspidiotus ancylus Putnam, Proc. Davenport Acad. Nat. Sci., ii, p. 346 (1879).

Aspidiotus ancylus Comst., Rep. U. S. Dep. Ag., 1880, p. 292 (1881).

Scale of female: Circular, 1—1.5 mm. diam. Brick-red exuviae covered by gray film of excretion; remainder of scale dark gray, or almost black, except light gray margin. A very delicate, white ventral scale is present. Show a tendency to gather in clusters two or three deep.

Scale of male: Of same color as female scale; is much smaller and elongated. Length, 1—1.5 mm.; width, .5—.6 mm.

Female: Only the median pair of lobes developed, somewhat separated with the mesal margins parallel; notched on lateral margin about one-third of distance from subtruncate apex, and frequently notched near apex on the mesal margin. Second lobes rudimentary, truncate, not extending beyond margin of segment. First interlobular incision rather wide and shallow, with variable, chitinous processes, usually straight, the inner the larger. Second interlobular incision similar; inner chitinous processes usually larger than the outer. Sometimes a very small incision laterad of second incision. Small chitinous process at inner base of each median lobe. There are two plates, usually furcated, caudad of each incision and occasionally a third plate. The spines on the ventral surface are shorter than the dorsal spines, and situated at the base of the lateral margin of the median lobes and the rudimentary second and third lobes. The spines of the dorsal surface are slightly mesad of the corresponding ventral ones; the fourth being about two-thirds of the distance from the median

lobes to the penultimate segment. Between the third and fourth pairs of spines, there are three or four irregular, spine-like extensions of the margin of the segment. Four or five groups of circumgenital gland-orifices are present; Median, 0-6, (rarely more than three); anterior lateral, 5-14; posterior lateral, 4-8. Rows of dorsal pores sometimes quite prominent.

Remarks: This scale popularly known as "Putnam's Scale," is not an important economic insect *per se*, but the possibility of mistaking the San Jose' Scale for this one, attaches to it more importance. The scales are lighter in color, and the "dot and ring" is not nearly so prominent as in the San Jose' Scale. Remedial measures for the latter are fully as effective for Putnam's Scale.

ASPIDIOTUS COMSTOCKI Johnson.

Fig. 9.

A. comstocki Johns., Ent. News, vii, p. 151 (1896).

A. comstocki Johns., Bull. Ill. St. Lab. Nat. Hist., iv, p. 383 (1896).

Scale of female: The shape depends upon the position upon the leaf, but usually approaches a semicircular form, attached close to the midrib, veins or veinlets of the leaf. Length, 1.5--2 mm.; width, 0.5--1 mm. Large, rather flat, cream-buff, excepting the part which covers the exuviae which varies from yellowish to reddish-brown, or is often concolorous.

Scale of male: Length, 1 mm., width 0.5 mm. Cream-buff or grayish-white, semi-transparent, more or less elongate oval. Exuvia submarginal.

Female: There are two pairs of well-developed lobes, the second pair often as long or longer, and as broad as the median pair, which are commonly notched on the lateral margins near the tip. Plates conspicuous. Between the first and second lobes, they are more or less toothed and about as long as median lobes; laterad of second lobe is a broad circular fringe; laterad of this are three large toothed plates. Spines prominent; a pair at outer base of median lobes, a pair at outer base of second lobes, the third on the rudimentary third lobe, and the fourth just laterad of the plates. Four groups of circumgenital gland-orifices; anterior lateral, about 6; posterior lateral, 4.

Remarks: Found on the leaves of Sugar Maple. (*Acer saccharum*) at Columbus, Ohio, associated with *Phenacoccus acericola* (King).

Aspidiotus cyanophylli Signoret.

Fig. 12.

A. cyanophylli Sign., Ann. Soc. Ent. Fr., (4), ix, p. 119 (1869).

Scale of female: Circular, brownish-yellow; exuviae central, bright yellow, covered by white secretion.

Scale of male: Similar to scale of female, elliptical in outline, exuvia sub-central.

Female: Median lobes very large, as broad as long, notched on each side near apex, appearing to project into the segment; second lobes long, narrow, about one-third the width of the median lobes, slightly notched on each side near apex; third lobe similar but smaller. Plates long, extending beyond lobes, deeply incised; two between median and second, three between second and third lobes, and outside of third lobe five or more simple bi-furcate or tri-furcate plates. Spines long and slender, not exceeding the plates in length; on the dorsal surface there is a spine on each lobe and one two-thirds of distance to penultimate segment; on the ventral surface a spine laterad of each corresponding dorsal spine except on the median lobe. A few smaller spines scattered over surface of segment. Four groups of circumgenital gland-orifices; anterior lateral, 4-5; posterior lateral, 3-5. Anal orifice large, remote from margin of segment.

Remarks: On leaves of palm, *Pritchardia filifera*, in Ohio State University Conservatory. Originally described by Signoret at Paris from *Cyanophyllum magnificum*.

Aspidiotus cydoniae crawii Ckll.

Fig. 19.

Aspidiotus crawii Ckll. Newell, on the North American Species of the Subgenera Diaspidiotus and Hemiberlesia. Bull. Ia. State Coll. of Agr. and Mech. Arts, No. 3. 1899.

Being unable to procure specimens of this species, the following description, and the illustration are taken from the above bulletin:

Scale of female: "Circular, 2 mm. in diam., convex, dull-reddish-gray; exuviae sublateral, inconspicuous with exception of the first skin which shows as a yellow prominence."

Female: "Female anal segment with median lobes long and close together, each lobe notched on both inner and outer margins, outside margin of lobe straight below notch; rudiment of second lobe wide, often notched; rudiment of third lobe slightly raised at inner angle. Median incisions narrow, edges straight; second and third incisions small. A small chitinous process at outer base of median lobe; a broad chitinous band surrounding each second and third incisions, either band sometimes, but rarely, divided at apex of incision so as to appear

as two processes. Two plates with numerous branches just laterad of median lobe; about three plates, simple and long, on rudiments of second and third lobes. A pair of spines from each lobe and a spine on lateral margin one-third of distance to penultimate segment. Ventral grouped glands forward, caudolateral group about opposite vaginal orifice; median none; cephalolateral, 5; caudolateral, 4."

Remarks: This species was originally described from specimens brought from Mexico, on grapevine (?), and found by Mr. Alex. Craw in the course of his quarantine work on the Pacific Coast. Reported in this state from a greenhouse at Springfield, on *Satania* sp.

ASPIDIOTUS FORBESI Johnson.

Figs. 1, 2.

A. forbesi Johns., Ent. News, vii, p. 151 (1896).

A. forbesi Johns., Bull. Ill. St. Lab. N. H., iv, p. 380, (1896).

A. forbesi Newell, Contr. Ia. Ag. Coll., No. 3, p. 14 (1899).

A. forbesi Felt., Bull. 46, N. Y. St. Mus., pp. 330, 347 (1901).

Scale of female: Average diam. 2 mm., rather convex, dirty gray, but lighter in color and more delicate than *A. ancylus* or *A. perniciosus*, with covered, sub-central, orange exuviae.

Scale of male: Length, 1 mm.; width, .5—.6 mm. Darker than scale of female, elongated; the covered, orange-colored exuvia situated anteriorly and more convex.

Female: Median lobes prominent, rounded at apex and notched midway on lateral margin, converging and almost meeting. Second lobes narrower, about one-half width of median lobes, obscurely pointed or rounded, and two or three notched on lateral margin. First and second inter-lobular incisions bounded by thick, chitinous processes, the inner the larger and of characteristic curved shape; also club-shaped processes at inner base of median lobes. Usually furcated prolongations of the the margin laterad of the second incision are present. Plates, very inconspicuous or absent except one or two caudad of second incision. Spines are borne on the ventral surface as follows: one on the lateral base of each lobe, one laterad of second incision one at one-third, and one at two-thirds of distance to penultimate segment. The dorsal spines are located just laterad of the corresponding ventral ones, except the first on the median lobe which is wanting. Rows of dorsal pores not prominent; first of 3-4; second of 5-12; third of 7-15. Five groups of circumgenital gland-orifices present; median, 1-4; anterior lateral, 4-7; posterior lateral, 3-5.

Remarks: Prof. Johnson proposed the popular name "Cherry Scale Insect" for this Coccid, and speaks of it as the

most dangerous scale insect then established in Illinois. As far as we have observed it has not become a pest in Ohio, although found in various localities and on several hosts. It can be distinguished from the San Jose Scale by the much lighter color of the scale and the orange-red exuviae; also the "dot and ring" is not noticeable.

ASPIDIOTUS GLANDULIFERUS Ckll.

Fig. 8.

Aspidiotus glanduliferus Ckll., Ohio Naturalist, ii, p. 287 (1902).

Scale of female: 2 mm. diam., slightly convex, blackish, with large sub-central to sub-lateral orange-ferruginous or almost vermilion exuviae, readily exposed by rubbing; removed from the bark, a conspicuous white patch is left.

Scale of male: Oval, broad, with covered exuvia and a white dot and ring.

Female: Broad oval with deep constriction between head and thorax. Color, bright orange; caudal margin stained with dark red brown. Median lobes very large, broad, scarcely produced; second lobes similar but smaller and more or less serrate, close; third lobes represented by small angular prominence. Chitinous thickenings of interlobular incisions, short and straight, subequal, but the inner the larger. Plates, spine-like; two between median lobes, two caudad of first incision and two or three slightly branched caudad of second incision. Spines quite large; on the dorsal surface, a spine is borne by the first, second and third lobes respectively; the fourth spine at about one-fourth, and the fifth at one-half the distance to the penultimate segment. On the ventral surface, the spines are mesad of the corresponding dorsal ones, except that they are lacking on the median lobes. Five groups of circumgenital gland-orifices; median, 4-5; anterior lateral, 15-18; posterior lateral, 7-10. Dorsal pores very numerous in four series; the first (below first interlobular incision) of 3 in a row; the second of about 17, and after a short break, 9-10 more; the third of over 30; the fourth of about 11. Anal orifice very small, level with second dorsal pore of first row.

Remarks: This scale was discovered in February, 1902, on the branches of *Pinus sylvestris* on the Ohio State University Campus, by the author, and sent to Prof. Cockerell, who described it as *A. glanduliferus*, because of the large number of beautifully arranged dorsal pores in the last segment of the female. Since that time the author has found this scale on *Pinus virginiana* and *Tsuga canadensis* on the O. S. U. Campus.

Aspidiotus hederæ (Vall.)

Figs. 10, 11.

Chermes hederæ Vall., Mem. Acad. Dijon, p. 30 (1829).*Aspidiotus nerii* Bouche, Schadl. Gart. Ins., p. 52 (1833).

Scale of female: Diam. 1.5—2 mm., flat, dirty white. dull-orange exuviae central or sub-central, exposed, usually showing segmentation of first skin.

Scale of male: Slightly elongated, white with light-yellow, sub-central exuvia. Length about 1 mm.

Female: Three pairs of lobes; median and second well-developed; the third small and pointed. The median are deeply notched on each margin near the apex, the mesal notch being slightly posterior, appearing to converge. The thick chitinous median lobes extend into the segment. Second lobes are often notched on lateral margin near the apex. The plates are nearly all deeply fringed; two between median, two between median and second, three between second and third, and about six fringed and two or three forked or simple ones laterad of third lobe. On the ventral surface, there is a spine at the lateral base of each lobe, one at one-third and one at one-half of distance to penultimate segment. On the dorsal surface, there is a spine mesad of the corresponding ventral spine. The dorsal pores are in four irregular rows; first of 3-4; second of about 7; third of about 6; fourth, near margin, of about 4. Four groups of circumgenital gland-orifices; anterior lateral, 8-9; posterior lateral, 6-7, appearing as if surrounded and connected by strips of chitin.

Habitat: On a great variety of hosts; citrus trees, palms, cycads, *Muhlenbeckia*, English Ivy; and on *Hepatica hepatica* being used for experimental purposes in the greenhouse of the Ohio State University.

ASPIDIOTUS JUGLANS-REGIAE Comstock.

Fig. 7.

Aspidiotus juglans-regiae Comst., Rep. U. S. Dep. Ag. 1880, p. 300 (1881).

Scale of female: Circular, flat, pale grayish-brown, 3 mm. diam. Reddish-brown, sub-central exuviae covered with secretion. Ventral scale a white, delicate film.

Scale of male: Similar in color to scale of female, but smaller, elongated, with anterior end and exuvia more convex. Length, 1—1.25 mm.

Female: Median lobes well-developed, produced, broad and close, round at apex with mesal corners well defined, slightly converging, notched near apex on outer margin. Second lobes narrower and dis-

tinctly two or three notched on outer margin. Third lobe rudimentary and raised to a point. A small chitinous process at inner base of median lobes; chitinous processes bounding first and second incision, the inner the larger. A pair of simple, inconspicuous plates between median lobes and one or two bifurcated ones caudad of each incision. Spines prominent, borne on the dorsal surface, one by each lobe, one one-third and another two-thirds of distance to penultimate segment. On the ventral surface, they are laterad of the corresponding dorsal spines. Rows of dorsal pores very noticeable and complete; first row of 3-4; second of 18-24; third of 20-22; fourth, in an irregular row, of 14-18. Five groups of circumgenital gland-orifices; median, 0-5; anterior lateral, 8-16; posterior lateral, 4-8. Anal orifice small, level with third dorsal pore of first row.

Remarks: This scale which was first described from English Walnut (*Juglans regiae*) by Prof. Comstock in 1880, has been found infesting various other trees, including some of our more valuable fruit trees, such as peach, apricot, plum, black cherry and pear. It has little economic importance in Ohio.

Aspidiotus lataniae Signoret.

Fig. 18.

A. lataniae Sign., Ann. Soc. Ent. Fr., (4), ix, p. 124 (1869).

Scale of female: Rather elongated, convex, clear-yellow, translucent at center, dirty white at margin of large elliptical exuviae.

Scale of male: Similar to the scale of the female in color, smaller and elongated.

Female: Mesal lobes only present, large, prominent, nearly as broad as long, notched on both margins, the inner notch much the smaller and nearer the apex. Two large interlobular incisions bounded by chitinous processes, the inner the larger, and one very small one, bounded by small chitinous processes, laterad of second incision. Usually a small chitinous process at inner base of median lobes. Two simple plates between median lobes; two incised plates caudad of first and second incision and one or more between them. Outside of the small third incision, the margin of the segment is produced to appear almost like two or three simple plates. On both dorsal and ventral surfaces, spines are located as follows: at outer base of median lobes, between first and second incision, just outside of second incision, and one about one-half of distance to the penultimate segment. Four groups of circumgenital gland-orifices; anterior lateral, 4-6, posterior lateral, 3-4. Second and third rows of dorsal pores of 8-12 each, rather straight and distinct although interrupted. Anal orifice large, rather remote from the margin.

Remarks: On palm, *Areca lutescens*, in Ohio State University Conservatory.

ASPIDIOTUS OSBORNI Newell & Ckll.

A. osborni New. & Ckll., Rep. Ia. Acad. Sci., v, p. 229 (1898).

Just before going to press this species was identified on twigs of *Quercus alba*, collected at Cleveland, Ohio, July 18, 1903, by the author. The grouped-gland-orifices in the Ohio specimens are more numerous than originally described.

ASPIDIOTUS OSTREAEFORMIS Curtis.

Fig. 3.

A. ostreaeformis Curt. (Ruricola), Gard. Chron., iii, p. 805 (1843).

A. ostreaeformis Felt, Bull. 46, N. Y. St. Mus., pp. 323, 352 (1901).

A. ostreaeformis Banks, Bull. 34, n. s., Dep. Ag., p. 18 (1902).

Scale of female: 1—1.5 mm. in diameter, dark gray, lighter near margin, somewhat convex; exuviae large, eccentric, yellowish to orange.

Scale of male: Similar in color to scale of female, smaller with submarginal exuvia.

Female: Median lobes short and broad, notched on outer margin and rounded, similar to *A. ancylus*, but not so prominent, scarcely converging, with inner margins thickened; inner angle of second lobe produced into a blunt point; rudimentary third lobe represented by a small angular prominence, or absent. Long, straight, subequal, chitinous processes bound the second and third incisions. Plates very inconspicuous, sometimes furcated; two between median lobes and two in each incision. On the ventral surface, a spine is borne at the lateral base of each lobe and one about half-way to the penultimate segment; the dorsal spines are longer and situated just mesad of the corresponding ventral spine. Dorsal pores in four rows as follows: 1st (between first pair of chitinous processes) of 2-3; 2nd, 5-6 and after a break 2-3 more; 3rd of 7-8; 4th, a marginal row of 2-4 and a group of 5-6 near the penultimate segment. The dorsal pores vary greatly in number and position, but there is a certain characteristic arrangement. Median group of circumgenital gland-orifices, 5-8; anterior and posterior lateral of about 10-12 each. Anal orifice small, rather distant from margin and embraced by the inner margins of median lobes.

Remarks: This is an European species, which has been introduced and is rather common in sections of some states, however not common in Ohio.

ASPIDIOTUS PERNICIOSUS Comstock.

Figs. 4, 75.

- A. perniciosus* Comst., Rep. U. S. Dep. Ag., 1880, p. 304 (1881).
A. perniciosus Howard, Yearbook U. S. Dep. Ag., p. 267 (1894).
A. perniciosus Webster, Bull. 56, Ohio Exp. Sta. (1895).
A. perniciosus Webster, Bull. 72, Ohio Exp. Sta., p. 211 (1896).
A. perniciosus Felt, Bull. 46, N. Y. St. Mus., pp. 304, 349 (1901).

Scale of female: Circular, slightly convex, 1—2 mm. in diam., gray or dark-gray except the prominent, covered, pale or reddish-yellow exuviae. The exuviae are nipple-like with a shallow, depressed ring about them, which is quite characteristic of this species.

Scale of male: Is black in color, rather convex with the nipple-like prominence and depressed ring still more noticeable than in the female. Usually more numerous than the female scales.

Female: Two pairs of lobes well-developed. Median prominent, rounded at the apex, notched on the outer margin near the middle, though somewhat variable, and converging. The thickened inner margins of the median lobes extends anteriorly encircling the anal orifice in a characteristic manner. The second lobes are smaller and narrower, though distinct, quite close to the median, notched on the outer margin, pointed and converging. Between the median lobes, and bounding each incision of the segment, are club-shaped, chitinous processes; the inner usually the larger. There are two inconspicuous plates between the median lobes, two caudad of first incision, and three small, laterally serrate ones, caudad of second incision. Often laterad of second incision are wide, furcated extensions of the margin of the segment. The spines of the ventral surface are situated laterad of the corresponding dorsal spines at the bases of the first and second lobes; the third pair laterad of second incision; the fourth pair at one-half of distance to penultimate segment. Groups of circumgenital gland-orifices are absent. Rows of dorsal pores are not prominent, though variable.

Remarks: The San Jose Scale is perhaps the most insidious of our noxious insects. Its apparent damage is not so great as are the ravages of the Colorado Potato-beetle, Army Worm, Chinch Bug and the Hessian Fly, but frequently a valuable fruit tree becomes so completely encrusted with hundreds of thousands of the scales, and the vitality is so diminished that it begins to wither and die; and then, and often not until then, is the cause discovered. In such a case what would be the proper course to follow? The axe and a hot fire would be the proper thing in such a case. However, if a tree is only partially infested or the

vitality not too greatly impaired, there are several spraying mixtures which can be used to advantage, viz., "Lime, sulphur and salt wash," "Oregon Wash," "Resin Wash," "Whale-oil soap wash," "Potash Wash," Kerosene emulsion, Crude petroleum, etc. The U. S. Dept. of Agriculture and various State Experiment Stations have from time to time issued bulletins containing information concerning the San Jose Scale, and recipes for the preparation of the above washes.

ASPIDIOTUS PICEUS Sanders.

Fig. 66.

A. piceus Sanders, Ohio Naturalist, iv, 4, p. 96 (1904).

Scale of female: 1.8—2 mm. in diameter, flat often subelliptical to oval, with sub-central exuviae; black shading to dark gray toward margin, having the appearance of pitch covered with dust. The raised shiny black, deciduous first exuvia is surrounded by an indistinct ring like depression. When rubbed the second orange exuvia appears. The young scales appear not unlike the young male scales of *A. pernicius*. When removed a white patch is left.

Scale of male: Elliptical, 1 mm. in length, black, with distinct ring-like depression surrounding the lustrous-black exuvia, the posterior flap shading to gray.

Female: With one pair of lobes, well-developed, prominent, broad, notched midway on lateral margin, with outer corners well rounded off toward inner angle. Inner margins parallel, not close, bounded by large chitinous processes, which extend, somewhat reduced in density, around the outer margin to a denser process at outer base of lobe. Second and third lobes rudimentary, sometimes with inner angle of second lobe slightly developed. Interlobular incisions broad and deep, bounded by elongated chitinous processes, the inner usually the larger. There are two perforations anterior to median lobes on a level with the base of chitinous processes of first incision. Between the median and second and the second and third lobes are pairs of di-pointed spine-like plates, two thirds of length of median lobes. On the dorsal surface there is a spine on each of the second and third lobes, and on the ventral surface, each lobe bears a spine on the lateral margin, laterad of dorsal spine, also spines one-third and two-thirds of distance to penultimate segment. First row of dorsal-pores (between first and second lobes) of 2; 2nd row of about 6; 3rd row of 5—6; 4th row (near margin) of 3—4 orifices. Four or five groups of circumgenital gland-orifices, median sometimes wanting. Median, 0—3; anterior lateral, 15—23, averaging 18; posterior lateral, 6—14, averaging 9.

Anal orifice very large, removed from margin by about three lengths of the median lobes.

Remarks: Found very abundantly on young *Liriodendron tulipifera*, at Painesville, Lake Co., Ohio, July 21, 1903. This species differs from *A. osborni*, its nearest species, by the jet-black exuviae, the very large anal orifice, and the numerous circumgenital gland-orifices.

Aspidiotus rapax (Comstock).

Fig. 20.

A. rapax Comst., U. S. Agr. Report of 1880, p. 307.

Scale of female: Very convex, gray almost white, translucent, appearing yellow because of color of insect beneath; the sub-central exuviae marked by a brown or black dot and a concentric ring. Ventral scale snow-white and usually entire.

Scale of male: Similar to scale of female, scarcely so convex, with exuvia sub-lateral.

Female: Median lobes only, well developed and prominent, sharply notched on either side, the mesal notch nearer the apex. Second and third lobes are represented by small, pointed projections of the margin. A deep incision laterad of the median and second lobes, bounded by subequal chitinous processes. Two irregularly toothed or branched plates caudad of each incision, with a simple one between them and two or three simple or furcated ones laterad of third lobe. On each surface, spines are located at the lateral bases of each lobe; the fourth spine at about two-thirds of the distance to the penultimate segment. The ventral fourth spine is slightly laterad of the corresponding dorsal spine. Groups of circumgenital gland-orifices absent. Dorsal pores in two or three irregular rows; the second of about 6; the third of about 4. The anal orifice is very large.

Remarks: This is a cosmopolitan insect in warm climates, found upon many hosts; the most important ones being almond, quince, fig, olive, acacia, locust, willow, eucalyptus, *Osmanthus* and other citrus trees.

ASPIDIOTUS ULMI Johnson.

Fig. 22.

A. ulmi Johns., Bull. Ill. Lab. Nat. Hist., Vol. iv, p. 388. 1896.

Scale of female: Almost round, 1.5—2 mm. in diameter, dirty white or tan-colored; the latter owing to the corky covering from the bark often apparent. New exuviae bright orange-yellow, older material is usually faded. A well developed, white, ventral scale.

Scale of male: About .7 mm. long, more or less circular, of the same general appearance as the scale of the female.

Female: One pair of lobes, prominent, about as long as wide, notched on each side, somewhat rounded. Only a slight indication of second lobes. Mesal half of median lobes extend anteriorly to a conical tip. Inner process of first incision very long, club-shaped and knobbed at anterior end and is very constant; outer process small, narrow. Processes of second incision subequal. Margin of segment thickened for half of distance to the penultimate segment. Two plates caudad of first incision; between first and second incision, three to four, and laterad of second incision three plates. On the dorsal surface, a spine is located at outer base of median lobes, between first and second incision, laterad of second incision, and about one-half of distance to penultimate segment. On the ventral surface there is a spine just laterad of the corresponding dorsal spine except the first on the median lobe. Dorsal pores very small, inconspicuous with very long ducts, in three series; 1st (extending anteriorly from first incision) of 4—5; 2nd of about 16; 3rd of about 9. Prof. Johnson found no circumgenital gland-orifices, but in 25 per cent. of the specimens examined, from one to three orifices were found in the place of the posterior lateral groups which are marked by chitinous bands. Anal orifice small and located anteriorly in distance three times the length of the median lobes.

Remarks: Found on the trunks and the older limbs of the white elm, *Ulmus americana* and *Catalpa*, at Columbus, Ohio.

ASPIDIOTUS UVAE Comstock.

Fig. 6.

A. uvae Comst., Rep. U. S. Dep. Ag., 1880, p. 309 (1881).

A. uvae Newell, Contr. Ia. Ag. Coll., No. 3, p. 12 (1899)

Scale of female: Circular, 1.5 mm. in diameter, rather flat, dusty tan-colored, lighter than dry bark of host. Exuviae sub-central, bright-yellow, covered. When removed leaves a conspicuous white spot.

Scale of male: Elongated, length 1 mm., width 0.5 mm, slightly darker than scale of female, with exuvia submarginal and more convex.

Female: Median lobes very prominent, parallel, notched on each margin and rounded, the mesal notch slightly nearer the apex; second and third lobes rudimentary with the inner angles slightly produced. Bounding each incision are two subequal chitinous processes, and between the median lobes are two narrow thickenings. There are two simple plates between the median lobes and two serrate ones caudad of each incision. Outside of third lobe, are 3—5 prolongations of the margin of the segment resembling plates and about as long as the spines. Spines on the dorsal surface are borne, one on each lobe and

one nearly half-way to the penultimate segment; the ventral spines are shorter and just laterad of the corresponding dorsal spine. Dorsal pores in three rows; 1st (at first interlobular incision) usually 2; 2nd, about 8; 3rd, about 4 and near the penultimate segment a group of 3-5. Median group of circumgenital gland-orifices 0-4; anterior lateral, 4-9; posterior lateral, 3-7. Accompanying the groups are peculiar chitinous bands or folds of the body-wall. Anal orifice embraced by extended inner margins of the median lobes. Immediately anterior from the median and second lobes, the segment is thicker and darker brown.

Remarks: Infests grape-vines, having a peculiar habit of arranging themselves in longitudinal rows on the stem of the host. Not common in Ohio, there being only two infested localities reported as yet.

Comstockiella sabalis (Comstock).

Fig. 25.

Aspidiotus ? sabalis Comst., 2nd Rep. Dep. Corn. Univ., p. 67 (1883).

Comstockiella sabalis Ckll. Check. List, p. 335 (1896).

Scale of female: Approximately circular, snowy white, 1.5-2 mm. broad, exuviae covered, prominent.

Scale of male: Similar to female scale in color, elongated, more convex.

Female: There are no lobes or plates; the margin of the segment is rather deeply notched. The female has rudimentary antennae of about two joints and is viviparous. Near the edge of the segment are five very long spines and two similar ones on the penultimate segment. Beginning at the meson on the ventral surface are four small spines equidistant extending to the penultimate segment, which itself bears two. There are also four orifices in two rows extending anteriorly near the mesal notch. There are six groups of circumgenital gland-orifices, anterior lateral, 4-6; intermediate, 5-7; posterior lateral, 8-15. The dorsal pores are very small, arranged in six cephalo-caudal lines.

Male: Yellow, wingless, with short, spindle-shaped antennae.

Remarks: This Coccid was placed provisionally in the genus *Aspidiotus* by Comstock in his Second Cornell Report. Found by the author on Sabal Palmetto in the O. S. U. Conservatory, at Columbus, Ohio.

Genus *CHRYSOMPHALUS* Ashm.

[Type, *Ch. aonidum* (Linn.)]

The members of this genus favor the Neotropical regions, although one species is common in Ohio and thrives in spite of

our winters. They have large, usually dark scales with covered exuviae. The last segment of the female presents no incisions, but instead, rather long, chitinous thickenings and strongly branched plates.

- A. Scale of female with jet-black exuviae obscurus
 AA. Scale of female delicate, semi-transparent, with orange
 exuviae; circumgenital gland-orifices absent aurantii
 B. Circumgenital gland-orifices present in four groups dictyospermi
 AAA. Scale of female dark reddish-brown, convex; second
 and third series of dorsal pores in double rows aonidum

Chrysomphalus aonidum (Linn.)

Fig. 13.

Coccus aonidum Linn., Syst. Nat., Ed. x, i, p. 455 (1758).

Chrysomphalus ficus Ashmead, Am. Ent., iii, p. 267 (1880).

Aspidiotus ficus Comst., Rep. U. S. Dep. Ag., 1880, p. 296 (1881).

Chrysomphalus aonidum Ckll., Biol. Centr. Amer., ii, pt. 2, p. 25 (1899).

Scale of female: Circular, 2 mm. diam., convex; nipple-like exuviae gray, surrounded by a ring of light reddish-brown; remainder of scale dark-brown to almost black.

Scale of male: Similar to scale of female in color, excepting long posterior gray flap. Diam. 0.6—0.8 mm.

Female: Three pairs of well-developed lobes; the median and second pairs are abruptly narrowed midway on their lateral margin; the third pair have two or three notches on the lateral margin. Six chitinous, linear to spatulate processes extend anteriorly from either margin of the three pairs of lobes. Chitinous processes on lateral margin of median and second lobes and on mesal margin of third lobe, longest. Margin of entire segment thickened with chitin, ending posteriorly in a broad, serrate lobe laterad of third lobe. Plates deeply fringed, conspicuous, slightly longer than lobes. Between median, and between median and second lobes, two; between second and third, three, and outside of third lobe are three compound fringed plates. The short spines on the ventral surface are situated on the lateral margins of each lobe including the apparent fourth lobe. On the dorsal surface, the spines are situated mesad of the corresponding ventral spine, except that they are wanting upon the median lobes. Dorsal pores numerous in three series; first (between median and second lobes) of 3; second in double row of about 20; third of about 23. Four groups of circumgenital gland-orifices; anterior lateral, 7—9; posterior lateral, 4—5.

Remarks: This species infests citrus trees, many palms, oleanders and other ornamental plants. It is a serious pest in conservatories, multiplying with astonishing rapidity.

Chrysomphalus aurantii (Mask.)

Figs. 15, 16.

Aspidiotus aurantii Mask., N. Z. Trans., xi, p. 199 (1878).

Aspidiotus aurantii Comst., Rep. U. S. Dep. Ag., 1880, p. 293 (1881).

Chrysomphalus aurantii Ckll., Check. List, Suppl., p. 396 (1899).

Scale of female: Light gray, translucent revealing the orange or reddish insect beneath. Central nipple-like exuviae similar to *Ch. aonidum*. Diam. about 2 mm.

Scale of male: Resembling female scale; with posterior gray flap. Exuvia lighter in color. Diam. 0.5—0.6 mm.

Female: Of a light-brown color and reniform shape; the thoracic segment extending posteriorly, exceeding tip of pygidium. Three pairs of well-developed lobes; median deeply notched on both margins, the mesal notch posterior to the lateral. The second and third pair are notched about midway on their lateral and often on their mesal margins. Laterad of the third lobe is a lobe-like, serrate projection of the segment. Extending anteriorly from either margin of the second, the lateral margin of the median and the mesal margin of the third lobes, are short spatulate chitinous processes. The plates are all deeply fringed on their lateral margins and exceed the lobes in length. Two between median, two between median and second, three between second and third lobes, and three compound plates between the third lobe and the serrate margin of the segment. On the dorsal surface, each lobe bears a spine. On the ventral, there is a spine at the lateral base of each lobe except the median. Dorsal pores not prominent, in three series; first of 2—3; second of about 10; third of about 7. Groups of circumgenital gland-orifices are absent.

Remarks: This species infests Citrus trees principally, although palms, etc., are affected. It multiplies rapidly and has caused much loss to growers of citrus fruits.

Chrysomphalus dictyospermi (Morg.)

Fig. 17.

Aspidiotus dictyospermi Morg., Ent. Mon. Mag., xxv, p. 352 (1889).

A. (Chrysomphalus) dictyospermi Ckll., Bull. 6, T. s., Dep. Ag., p. 23 (1897).

Scale of female: Grayish-white, oval, depressed; exuviae central, light-yellow to dark-orange.

Scale of male: Similar in color to scale of female, elongated; exuvia subcentral, orange.

Female: Three pairs of well-developed lobes, notched on outer margin and narrowed at outer base; third lobe slightly smaller than median and second lobes. Extending anteriorly from either margin of the median and second lobes, and the inner margin of the third lobe, are long clavate, chitinous processes; those on the outer margins the longer. Outside of third lobe is a thickened, serrate, projection of the margin. Plates as long as lobes, fringed; two between median, two between median and second, three between second and third lobes, and outside of third lobe are two peculiarly fringed plates longer than the lobes. Spines short and inconspicuous, borne on the dorsal surface by each lobe and one close to penultimate segment; the ventral spines are just laterad of the corresponding dorsal spines. Dorsal pores in three rows; 1st (between median and second lobes) of two, 2nd of three to four, 3rd of four to six. Four groups of circumgenital gland-orifices; anterior lateral, 3—4; posterior lateral, 2.

Remarks: Occurs as a greenhouse species in the Northern United States. Found in the Ohio State University Conservatory on *Ficus pumila* var. *minor*, *Palm*, *Pandanus*, and on a small potted *Arbor Vitae*.

CHRYSOMPHALUS OBSCURUS (Comst.)

Aspidiotus obscurus Comst., Rep. U. S. Dep. Ag., 1880, p. 303 (1881).

Chrysomphalus obscurus Leon., Riv. Pat. Veg., vii, p. 205 (1899).

Aspidiotus obscurus Hunter, Kan. Univ. Quar., viii, p. 7 (1899).

Aspidiotus obscurus Hunter, Kan. Univ. Quar., ix, p. 107 (1900).

Scale of female: Very dark gray, only slightly convex and agreeing in color with the bark of host is difficult to detect; exuviae jet black.

Scale of male: Similar to scale of female in color, oval, convex anteriorly.

Female: Three pairs of well-developed lobes and the posterior tip of the thickened and notched margin of the segment apparently forming a fourth lobe. Median pair broad, rounded; second and third pair rather close, converging and serrate on the outer margin. Eight short club-shaped, chitinous processes on each side of the meson; two bounding the first incision, the inner much the larger; three at second and third incisions respectively, the middle one the larger and longer. The plates are short and inconspicuous, one between the median lobes and the median and first lobes respectively; two between second and third lobes and two slightly furcated ones laterad of third lobes. On the dorsal surface, spines are borne at the outer base of second and third lobes; one laterad of third incision, and one about one-half of

distance to penultimate segment. The ventral spines are just laterad of the corresponding dorsal spines. Two kinds of dorsal pores, oval and small round ones, in three rows; 1st, of about 4; 2nd of about 18 oval and anteriorly several round ones; 4th of about five and several rounded ones. Five groups of circumgenital gland-orifices; median of about 6; anterior lateral of 12; posterior lateral of about 7.

Remarks: We have taken this species from *Quercus coccinae*, *Q. acuminata*, *Q. macrocarpa*, and *Hicoria alba*. It is difficult to detect on account of its close resemblance in color to the bark of the host.

Genus LEPIDOSAPHES Shimer.

The species of this genus have a long narrow scale with the exuviae at one extremity. The male scale resembles the female scale in form and color, but is much smaller and bears only one exuviae. *Lepidosaphes ulmi* (L.), better known as the "Oyster-shell scale" or "Oyster-shell Bark Louse," is a serious pest on Poplar trees in some sections of Ohio, especially in the North-eastern part of the state. *Lepidosaphes beckii* (Newm.) occurs in the state only as a greenhouse species, or is shipped into the markets on oranges, as is also *L. gloverii* (Pack.).

Lepidosaphes beckii (Newm.).

Fig. 41.

Coccus beckii Newm., The Entom., iv, p. 217, Feb. (1869).

Aspidiotus citricola Pack., Guide to Study of Insects, p. 527, Aug. (1869).

Mytilaspis citricola Comst., Rep. U. S. Dep. Ag., 1880, p. 321 (1881).

Scale of female: About 3 mm. in length, more or less curved, gradually broadened posteriorly, brownish-purple, with exuviae slightly lighter in color. The white ventral scale is well developed.

Scale of male: Length, 1.5 mm., nearly straight, similar in color to scale of female, often darker with exuvia pale-yellow. With posterior hinge as in *L. ulmi*.

Female: Median lobes short and broad, well-developed, obscurely pointed, serrate; inner lobule of second lobe the larger and usually serrate; third lobe rudimentary, notched in the middle. Plates and spines similar to those of *L. ulmi*, except that there are 4—7 plates or spines upon the lateral lobules of the penultimate segment. Second row of dorsal pores (extending anteriorly from the 2nd pair of plates) of about 12, remote from margin of segment; third row absent; fourth of about 4. Median group of circumgenital gland-orifices, 5—6; anterior lateral, 10—18; posterior lateral, 7—9.

Remarks: This species infests Citrus trees under glass in Ohio, and is frequently seen on Oranges in the markets.

Lepidosaphes gloverii (Pack.).

Coccus gloverii Pack., Guide to Study of Ins., Ed. i, p. 527 (1869).

Mytilaspis gloverii Comst., Rep. U. S. Dep. Ag., 1880, p. 323 (1881).

This peculiar, long, narrow scale was found on oranges in the Columbus markets. It is often associated with the preceeding species.

LEPIDOSAPHES ULMI (Linn.)

Figs. 40, 75.

Coccus ulmi Linn., Syst. Nat., Ed. x. i, p. 455 (1758).

Mytilaspis pomorum Comst., Rep. U. S. Dep. Ag., 1880, p. 325 (1881).

Mytilaspis pomorum Newell, Bull. 43, Ia. Exp. Sta., p. 159 (1899).

Scale of female: Long, 2.5—3 mm., more or less curved, gradually widened posteriorly, brown or dark-brown, shining, thick in texture, with exuviae yellowish or yellowish-brown.

Scale of male: Similar in color to scale of female, but smaller. The posterior one-fourth of the scale bends upward like a hinge for the exit of the male.

Female: The median lobes are large, broader than long with parallel margins, deeply notched on each side near the apex and rounded; slightly diverging. Lobules of second lobe rounded; the mesal much the larger. Third lobe rudimentary. Plates long, simple; two in each of the following places: between median lobes, between first and second and between second and third lobes, laterad of third lobe, and one about half-way to penultimate segment. There is an elongated pore laterad of first lobe, two laterad of the third and fourth pairs of plates respectively, and one laterad of the fifth pair of plates. The spines on the dorsal surface are longer than the ventral spines and situated as follows: one at base of each margin of first lobe, one dorsad of incision of second and third lobes respectively, and one between the fourth and fifth pair of plates. On the ventral surface, there is a spine at the base of each margin of the median lobe, third spine at base of outer margin of outer lobule of second lobe, and the fourth and fifth spines between the fourth and fifth pairs of plates respectively. There are four or five spines on the lateral lobules of the penultimate segment. Second row of dorsal pores, (extending anteriorly from the third pair of plates) of about 12 small rounded orifices; third row of about 10; fourth row (near margin) of about 6. Median group of circumgenital gland-orifices, 10—18; anterior lateral and posterior lateral, 16—22 each.

Remarks: This is undoubtedly a cosmopolitan species and has been described under various names in several countries. The scale is popularly called the "Appletree Bark Louse," though not confined to apple trees. Perhaps the greatest damage is done on Poplars and Willows. In the northeastern part of Ohio this scale is plentiful, and in instances many Poplars have been killed by its attack. This is a difficult scale to combat, but the same measures as used for the San Jose' Scale will prove successful.

Genus PARLATORIA Targ.

The two species which are reported for Ohio are both greenhouse species, or rather in this case *P. zizyphus* (Lucas) was found on oranges and lemons in the Columbus markets. *Parlatoria pergandii* Comst. affects Citrus trees most seriously.

A. Scale of female circular

pergandii

AA. Scale of female elongated, black

zizyphus

Parlatoria pergandii Comstock.

Fig. 24.

P. pergandii Comst., Rep. U. S. Dep. Ag., 1880, p. 327 (1881).

P. pergandii Comst., 2nd Rep. Dep. Ent. Corn. Univ., p. 113 (1883).

Scale of female: Circular to elongated, irregular, dirty-gray, 1.6 mm. in length; exuviae marginal, brown, the first naked and the second covered by a thin film of secretion, occupying nearly one-third of length of scale.

Scale of male: Long and narrow, lateral margins prominent, not carinated, light gray with terminal exuvia darker.

Female: Three pairs of well-developed lobes, nearly equal in size, broadest near the middle tapering anteriorly, notched deeply on each side near the apex. A rudimentary fourth lobe, produced into a papilla, half-way between third lobe and penultimate segment. A crescent-shaped thickening of the body-wall appears between the median lobes, between median and second, second and third, and two thickenings between third and fourth lobes and between fourth lobe and penultimate segment. The plates are as long as the lobes and fringed on the distal margin. Two between median lobes, two between median and second, three between second and third, three between third and fourth, and three palmate plates cephalad of fourth lobe. On the three segments preceeding the last, are five or six plates, each produced into a papilla. A spine on the dorsal surface of each lobe near the margin; on the ventral surface, the spines are situated laterad

of the second, third and fourth lobes respectively. Four groups of circumgenital gland orifices, each of about 7, but varying from 5—10.

Remarks: This species infests Citrus trees in Florida, occurring in Ohio only under glass. Being so nearly the color of the bark, it is scarcely noticeable until a tree is badly infested.

Parlatoria zizyphus (Lucas).

Fig. 23.

Coccus zizyphus Lucas, Ann. Soc. Ent. Fr., (3), i, xxviii. (1853).

Parlatoria zizyphi Comst., 2nd Rep. Dep. Ent. Corn. Univ., p. 115 (1883).

Scale of female: The scale is almost covered by the very black exuviae, the first being oval and the second quadrangular. On the middle line is a ridge in a longitudinal depression.

Scale of male: Long, parallel-sided, light-brown, terminal exuvia black.

Female: Similar to female of *P. pergandii*, except that the three segments preceeding the last bear numerous irregularly incised plates, and the fourth lobe is long and sharp-pointed. The lobes are somewhat smaller than in *P. pergandii*.

Remarks: This species is a native of Europe, infesting orange and lemon trees, and is frequently seen on imported fruit in the markets.

DIRECTIONS FOR COLLECTING AND MOUNTING COCCIDAE.

A few words in regard to collecting Coccidae might be fitting and helpful to beginners. Coccidae are seldom found in this region on anything except trees and shrubs, although many herbaceous plants are infested by Aphids and Aleurodids. Perhaps the most satisfactory method in collecting scale insects in the field, is to put them in envelopes, properly labeled, until the collector can procure suitable glass tubes or bottles, which should contain all data upon a slip of paper. Until the material is perfectly dry, a plug of cotton should be used; otherwise the contents will soon mould. Finally; when you have collected as much of any species as you think necessary, collect as much more, it will never come amiss; in other words, always collect plenty, if possible.

If the specimens to be mounted belong to the *Diaspinae*, carefully lift the scale revealing the small flat inset beneath, which

should be transferred to a drop of water upon a glass slide. (Often under the scales of *Chionaspis* will be found a great quantity of eggs and the female shrunk into the very tip of the scale.) After sufficient have been procured in this way, it is an easy matter with a medicine dropper and a strong solution of KOH (Potassium hydroxide) to run off the specimens into a test tube, in which they should be boiled until clear and transparent, (sometimes it is necessary to prick a hole in the specimens to allow the body contents to escape.) Before the KOH solution cools, the cleared specimens should be run through 50 per cent. and 100 per cent. alcohol. Now they can be put on a slide in proper mounting position, and the excess of alcohol can be taken up with strips of blotting paper. Allow the alcohol to evaporate and then put on several drops of Xylol; after a few moments the Xylol may be removed and the specimens are ready for mounting in the usual manner, in Canada balsam.

If the specimens are of the nature of *Lecaniums* or "*Mealy Bugs*," i. e. not separable from the scale, the entire insect must be prepared and mounted in the foregoing manner.

Complete data as follows should be given on proper labels:—scientific name, host, locality, date, other interesting notes and the collector's name.

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ALSO A FEW COMMON NAMES OF ECONOMIC SPECIES.

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EXPLANATION OF PLATES.

Wherever in illustrating the *Diaspinae*, a vertical line is drawn through a figure, the dorsal surface of the pygidium is shown on the left side and the ventral on the right. The figures are numbered consecutively, and no mention is made of the various plates in the descriptions.

The majority of the plates were designed before Mrs. Fernald's "Catalogue of the Coccidae of the World" was published, hence some of the names inserted with the drawings are to be disregarded, and the following ones adopted:

Plate I. (Original)

- Fig. 1. Pygidium of *Aspidiotus forbesi* Johns.
- Fig. 2. Part of same enlarged.
- Fig. 3. *Aspidiotus ostreaeformis* Curt.
- Fig. 4. *Aspidiotus perniciosus* Comst.
- Fig. 5. *Aspidiotus ancylus* Putn.
- Fig. 6. *Aspidiotus uvae* Comst.
- Fig. 7. *Aspidiotus juglans-regiae* Comst.
- Fig. 8. *Aspidiotus glanduliferus* Ckll.
- Fig. 9. *Aspidiotus comstocki* Johns.

Plate II. (Original)

- Fig. 10. *Aspidiotus hederæ* (Vall.)
- Fig. 11. *Aspidiotus hederæ* (Vall.)
- Fig. 12. *Aspidiotus cyanophylli* Sign.
- Fig. 13. *Chrysomphalus aonidum* (Linn.)
- Fig. 14. *Chrysomphalus obscurus* (Comst.)
- Fig. 15. *Chrysomphalus aurantii* (Mask.)
- Fig. 16. *Chrysomphalus aurantii* (Mask.)
- Fig. 17. *Chrysomphalus dictyospermi* (Morg.)

Plate III. (Original)

- Fig. 18. *Aspidiotus lataniae* Sign.
- Fig. 19. *Aspidiotus cydoniae crawii* Ckll.
- Fig. 20. *Aspidiotus rapax* Comst.
- Fig. 21. *Fiorinia fioriniae* (Targ.)
- Fig. 22. *Aspidiotus ulmi* Johns.
- Fig. 23. *Parlatoria zizyphus* (Lucas).
- Fig. 24. *Parlatoria pergandii* Comst.
- Fig. 25. *Comstockiella sabalis* (Comst.)

Plate IV. (Original)

- Fig. 26. *Chionaspis corni* Cooley.
Fig. 27. *Chionaspis corni* Cooley.
Fig. 28. *Chionaspis euonymi* Comst.
Fig. 29. *Chionaspis caryae* Cooley.
Fig. 30. *Chionaspis furfura* (Fitch).
Fig. 31. *Chionaspis americana* Johns.

Plate V. (Original)

- Fig. 32. *Chionaspis salicis-nigrae* (Walsh).
Fig. 33. *Chionaspis salicis-nigrae* (Walsh).
Fig. 34. *Chionaspis pinifoliae* (Fitch).
Fig. 35. *Chionaspis pinifoliae* (Fitch).
Fig. 36. *Chionaspis gleditsiae* Sanders.
Fig. 37. *Chionaspis gleditsiae* Sanders.
Fig. 38. *Hemichionaspis aspidistrae* (Sign.)
Fig. 39. *Howardia biclavis* (Comst.)

Plate VI. (Original)

- Fig. 40. *Lepidosaphes ulmi* (Linn.)
Fig. 41. *Lepidosaphes beckii* (Newm.)
Fig. 42. *Diaspis boisduvalii* Sign.
Fig. 43. *Diaspis echinocacti cacti* Comst.
Fig. 44. *Aulacaspis rosae* (Bouche').
Fig. 45. *Aulacaspis rosae* (Bouche').

Plate VII. (Original)

(Upper half.)

- Fig. 46. *Pseudococcus citri* (Risso)., adult female.
Fig. 47. *Pseudococcus citri* (Risso)., anal ring and penultimate segment.
Fig. 48. *Pseudococcus citri* (Risso)., antennae of adult female.
Fig. 49. *Pseudococcus longispinus* (Targ.), adult female.
Fig. 50. *Pseudococcus longispinus* (Targ.), antennae of adult female.
Fig. 51. *Pseudococcus longispinus* (Targ.), anal ring and penultimate segment.
Fig. 52. *Pseudococcus trifolii* (Forbes), anterior leg of adult female.
Fig. 53. *Pseudococcus trifolii* (Forbes), anal ring and penultimate segment.
Fig. 54. *Pseudococcus trifolii* (Forbes), antenna of adult female.
Fig. 55. *Kermes pubescens* Bogue.
Fig. 56. *Orthezia insignis* Dougl.

(Lower half.)

Phenacoccus osborni Sanders.

1. Adult male. 2. Balancer with hook fitting into pocket in wing.
3. Posterior tarsus of male. 4. Adult female. 5. Posterior tarsus of female. 6. Lateral anal lobe of female. 7a, 7b. Female antennae.

Plate VIII. (Original)

- Fig. 57. *Orthezia solidaginis* Sanders, dorsal view of adult female.
Fig. 58. *Orthezia solidaginis* Sanders, anterior leg of adult female.
Fig. 59. *Orthezia solidaginis* Sanders. tarsus and claw of adult female.
Fig. 60. *Orthezia solidaginis* Sanders, antenna of adult female.
Fig. 61. *Orthezia solidaginis* Sanders, (immature stage, female) dorsal view.
Fig. 62. *Orthezia solidaginis* Sanders, (immature stage, female) ventral view.
Fig. 63. *Orthezia solidaginis* Sanders, (immature stage, female) antenna.
Fig. 64. *Chionaspis sylvatica* Sanders, pygidium of female.
Fig. 65. *Chionaspis sylvatica* Sanders, pygidium enlarged.
Fig. 66. *Aspidiotus piceus* Sanders, part of pygidium.

Plate IX. (Original)

- Fig. 67. *Kermes pubescens* Bogue.
Fig. 68. *Kermes andrei* King.
Fig. 69. *Kermes pettiti* Ehrh.
Fig. 70. *Kermes arizonensis* King.
Fig. 72. *Kermes kingii* Ckll.
Fig. 73. *Kermes galliformis* Riley.
Fig. 74. *Chionaspis salicis-nigrae* (Walsh). (Willow Scurfy-Scale).
Fig. 75. *Lepidosaphes ulmi* (Linn.) (Oyster-shell Scale).
Fig. 76. *Diaspis echinocacti cacti* Comst. (Cactus Scale).
Fig. 77. *Orthezia solidaginis* Sanders.
Fig. 78. *Aspidiotus perniciosus* Comst. (San Jose' Scale).

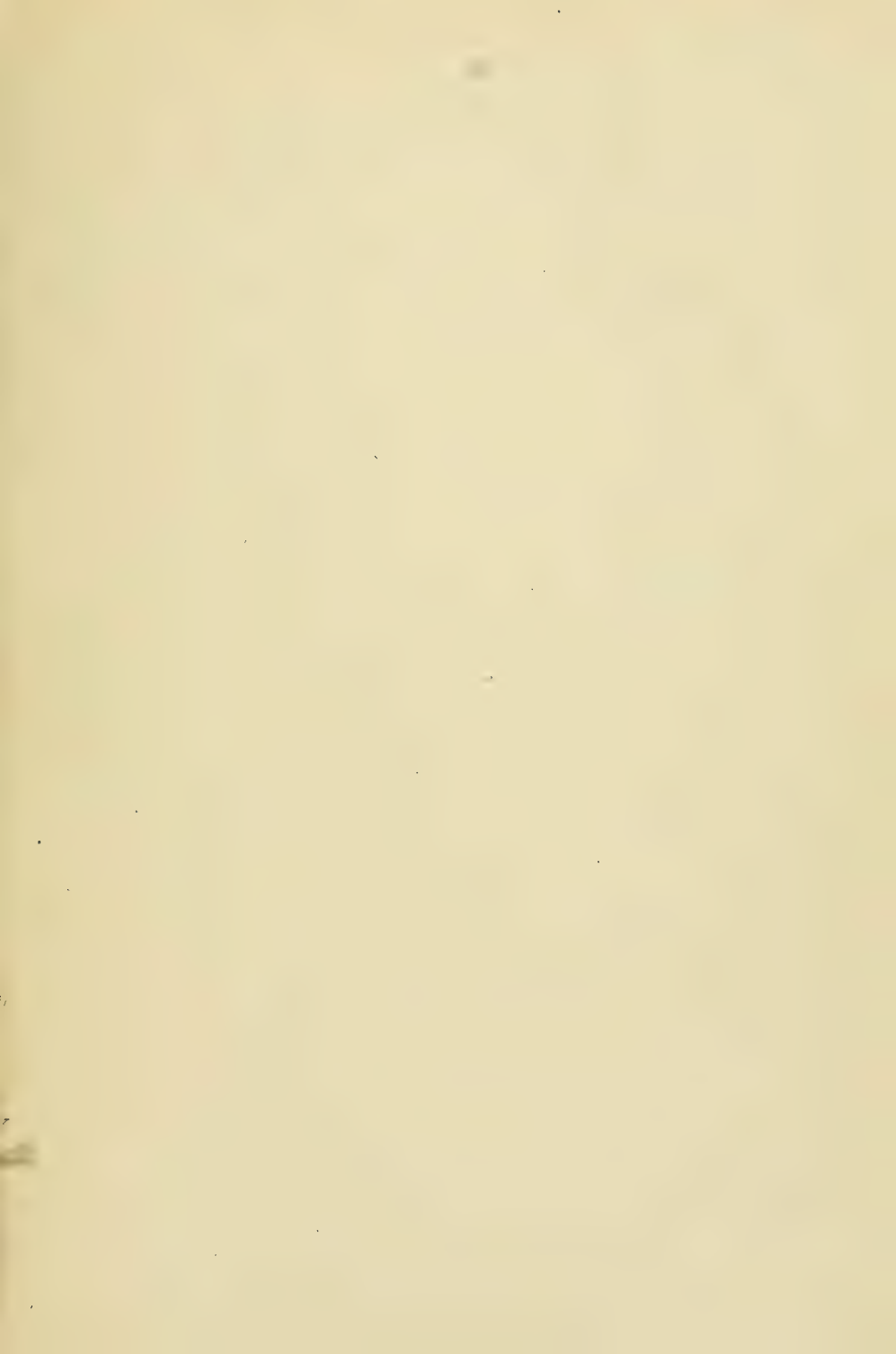


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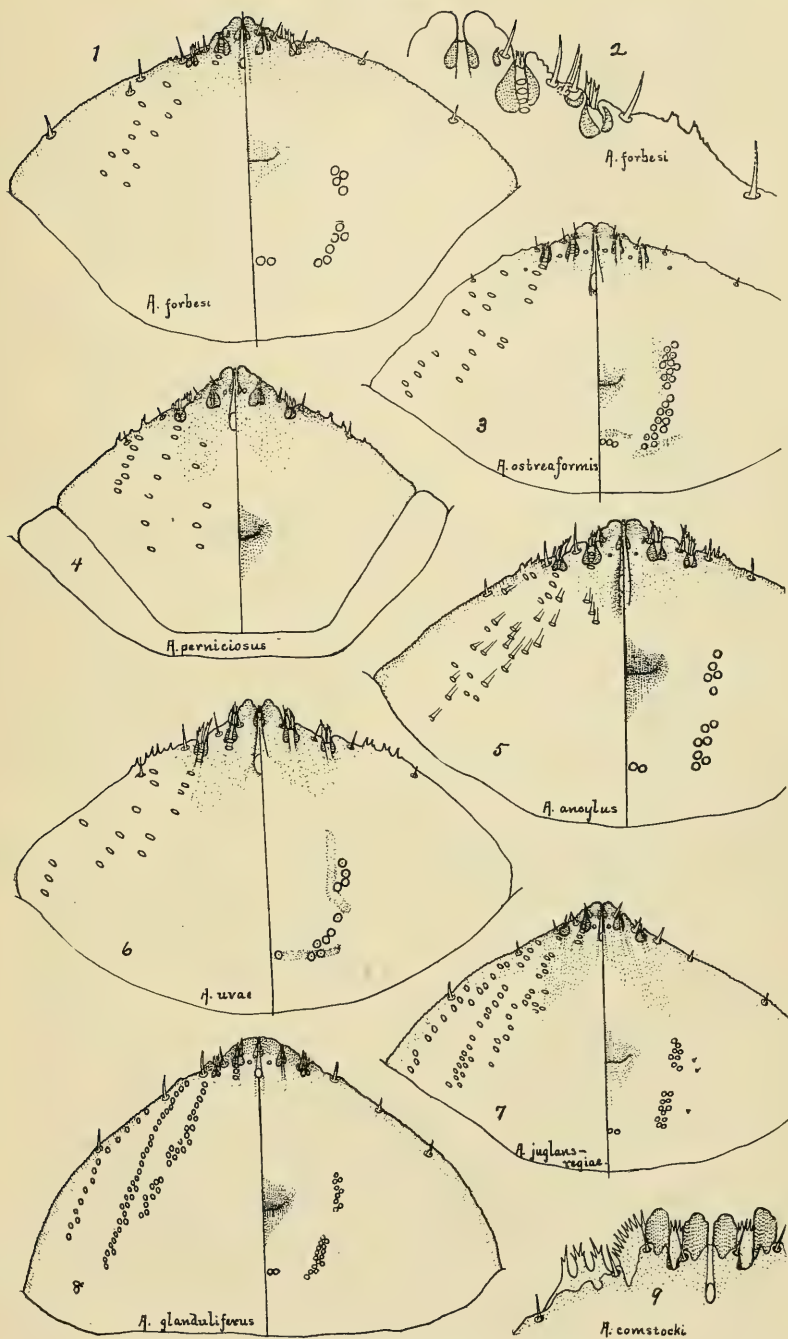
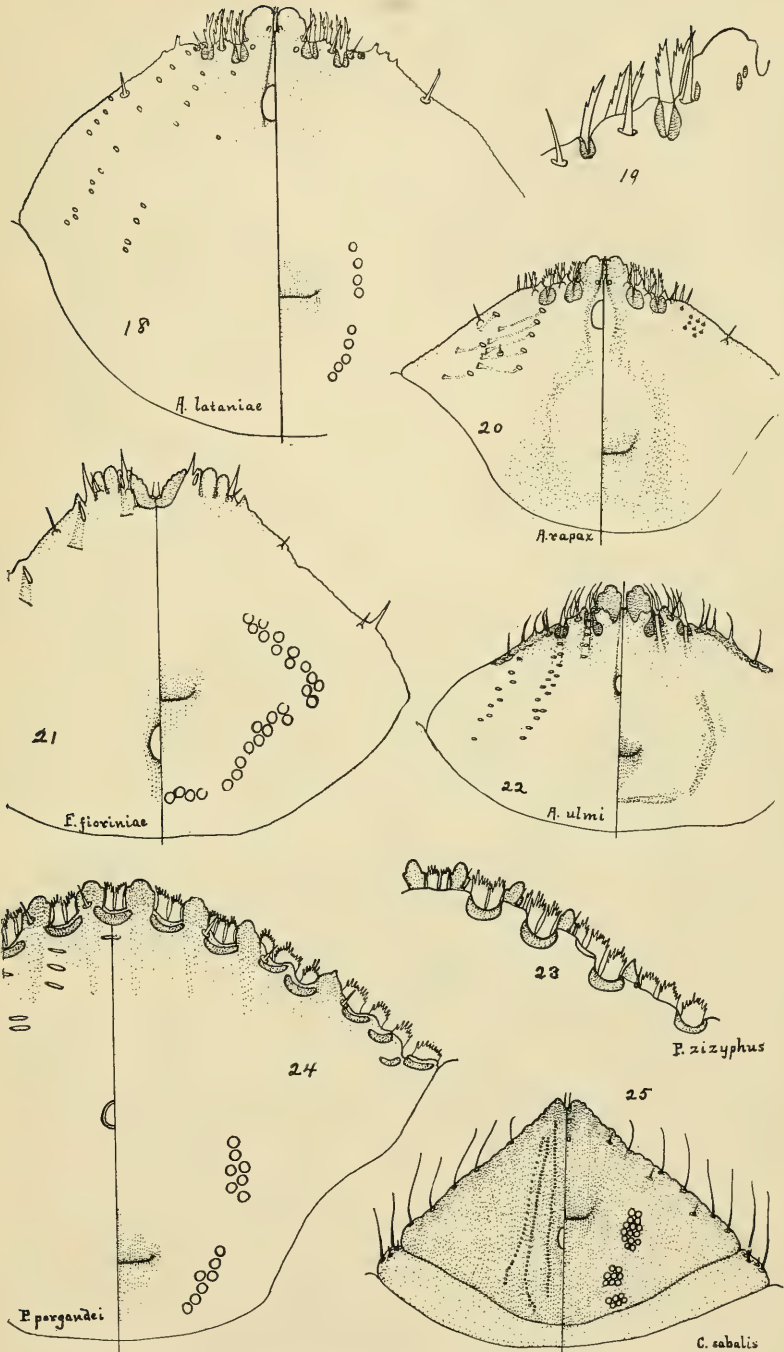
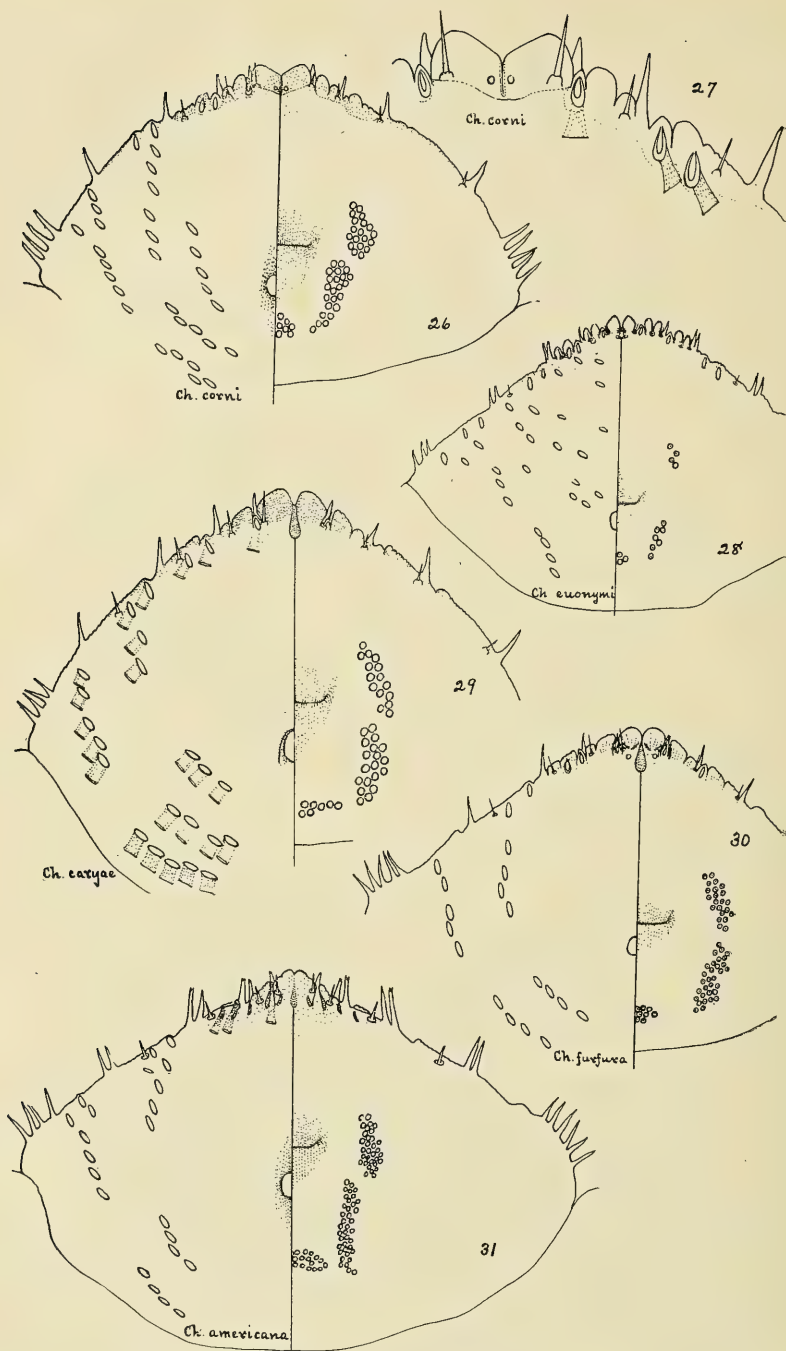


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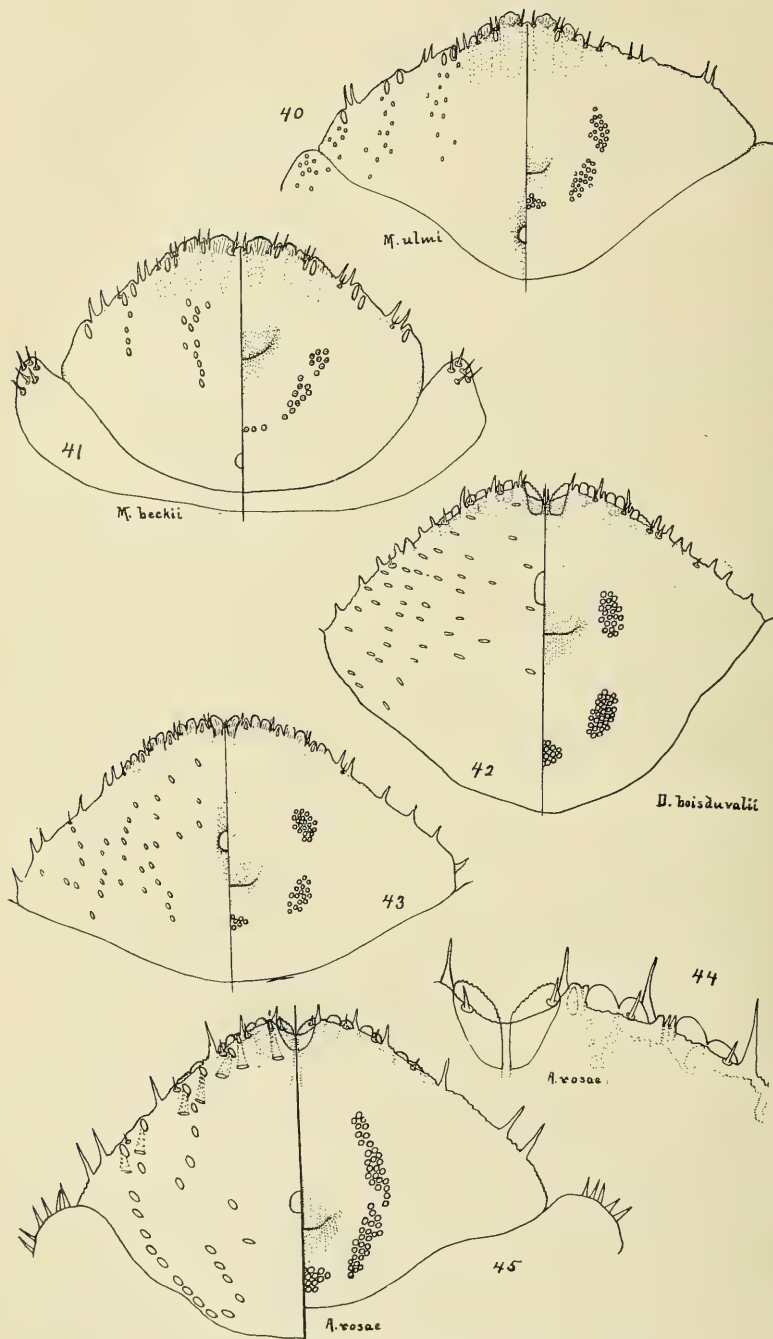




Sanders on Coccidae of Ohio.



Plate 6.



Sanders on Coccidae of Ohio.

Plate 7.

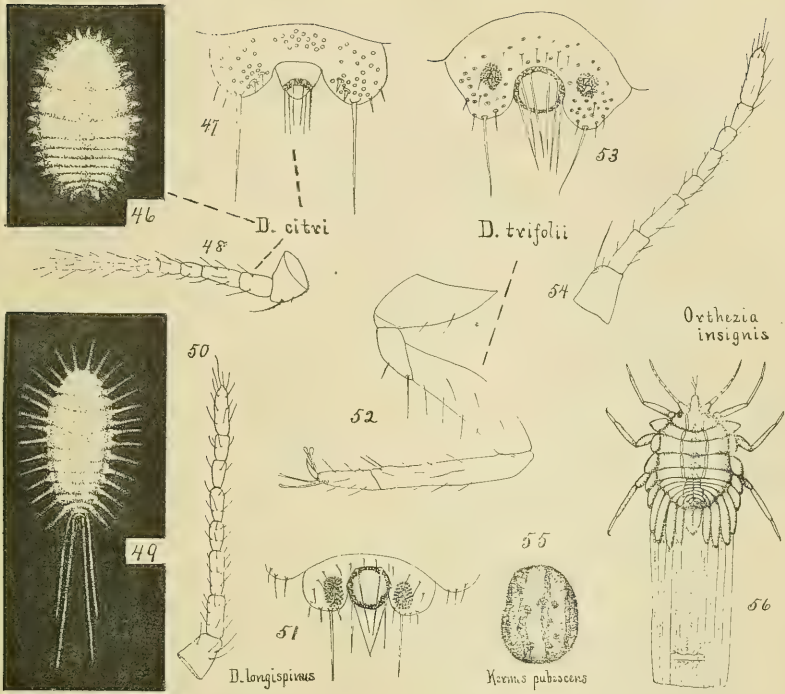
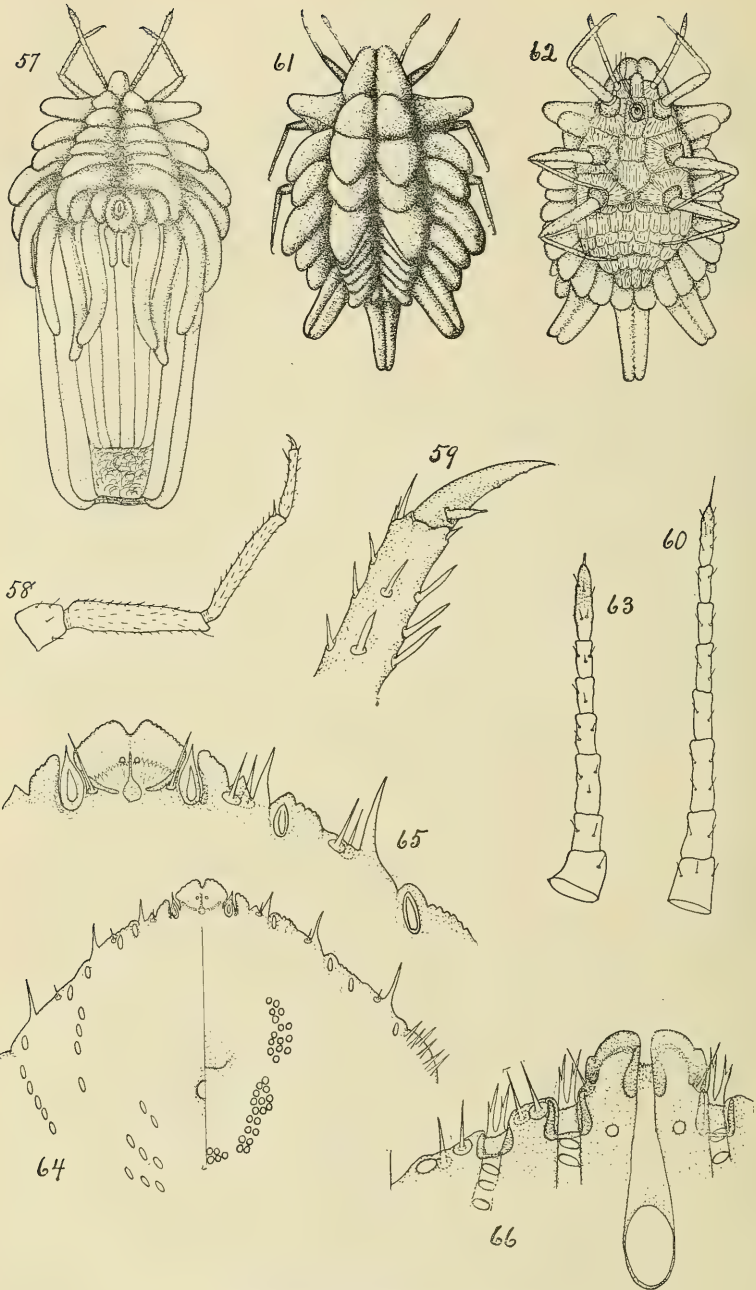
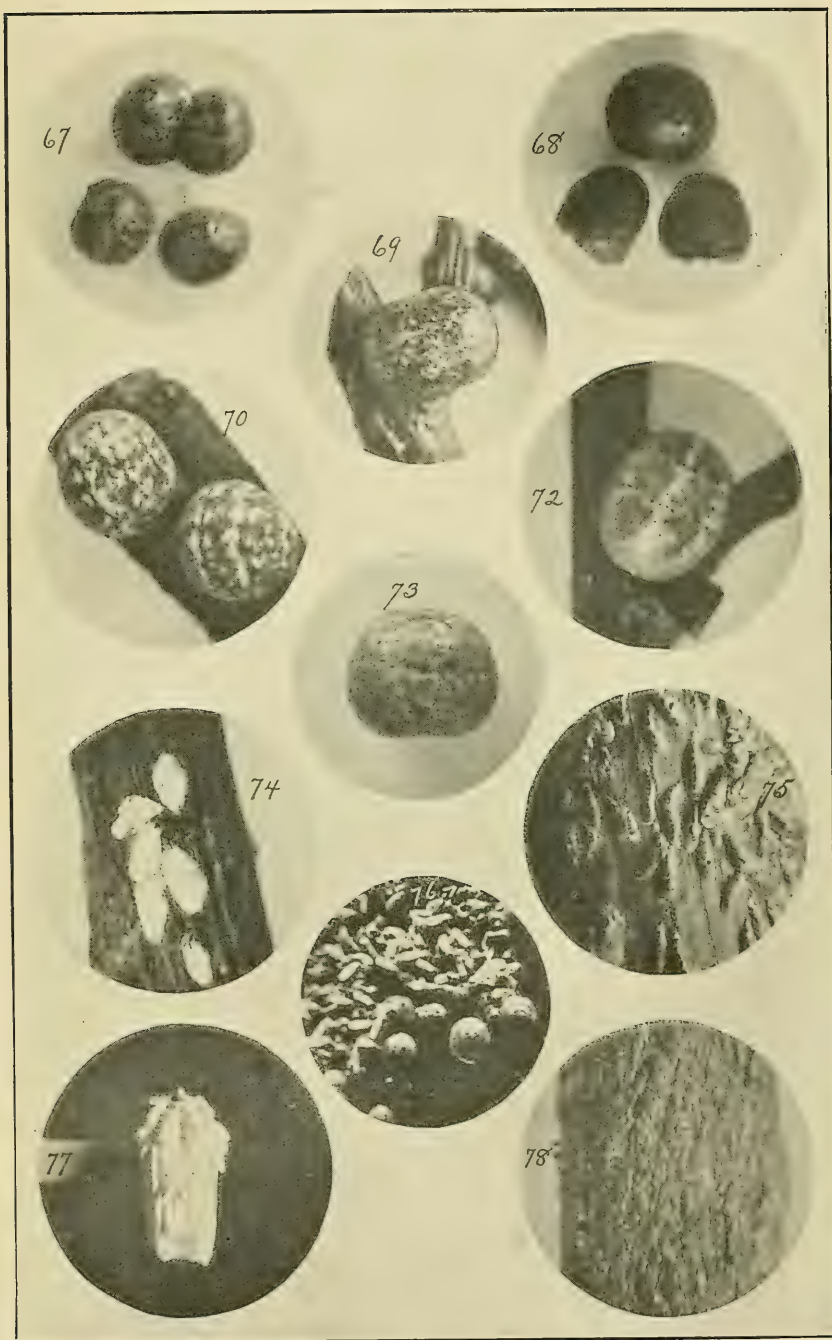
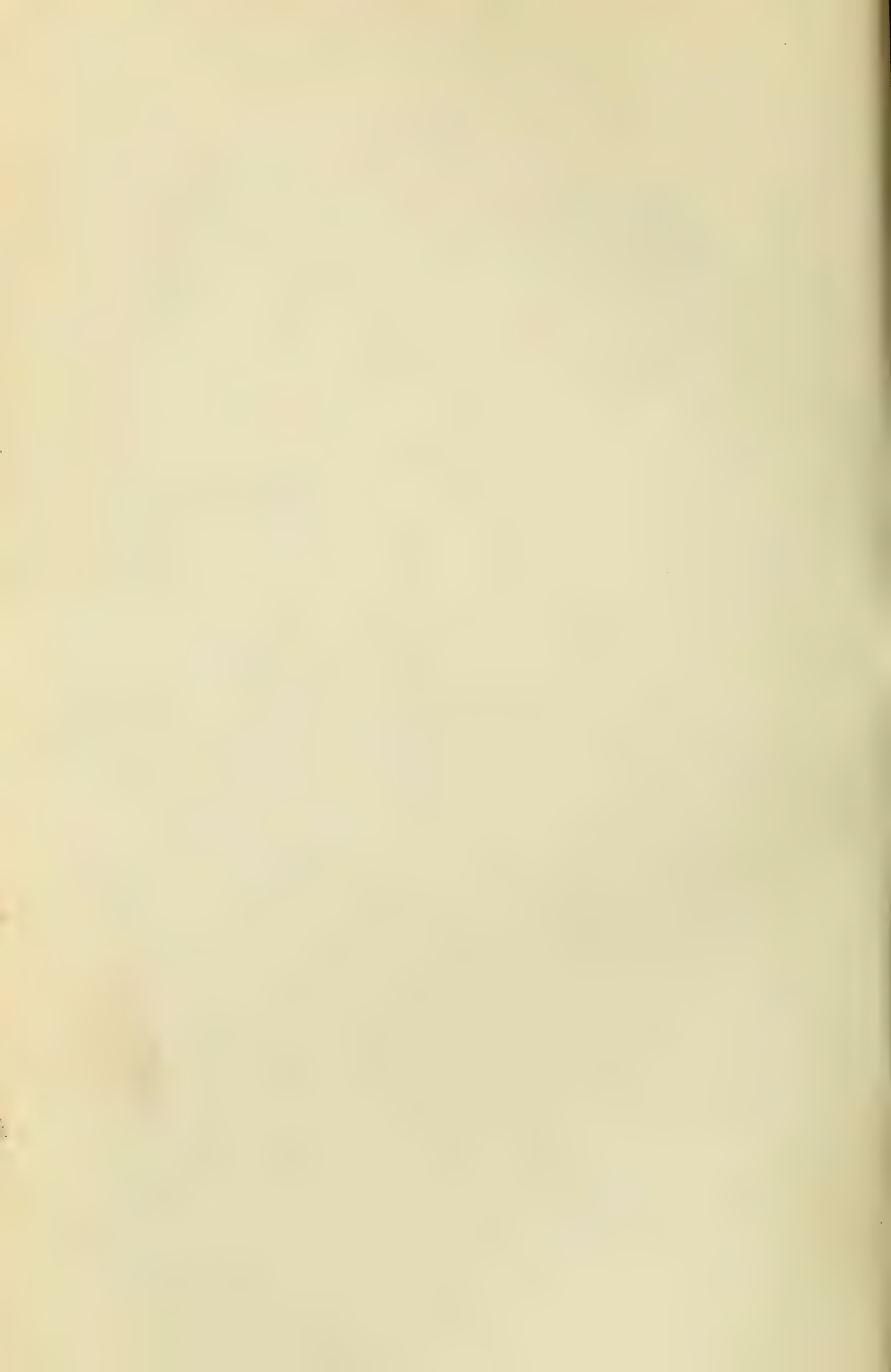
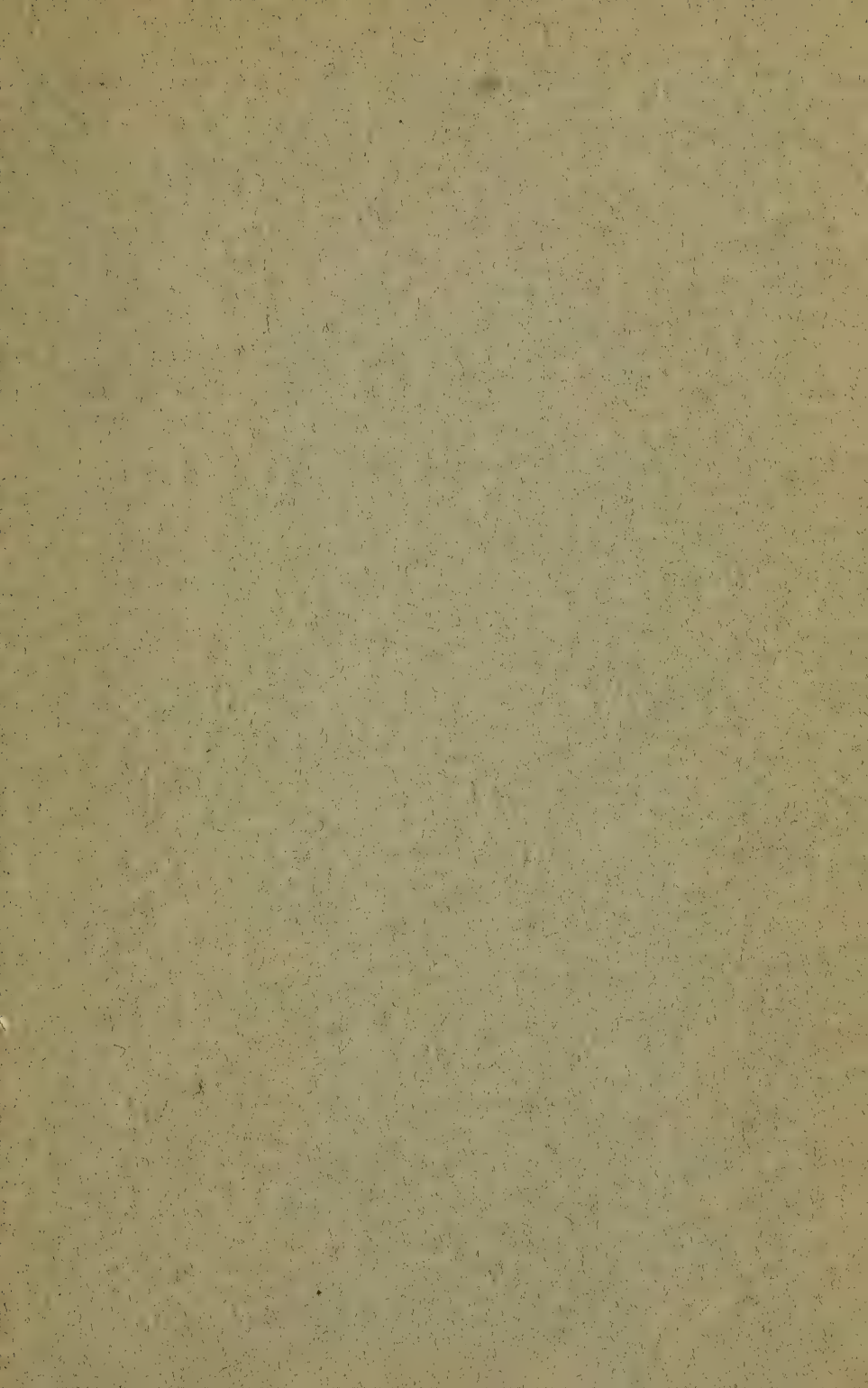


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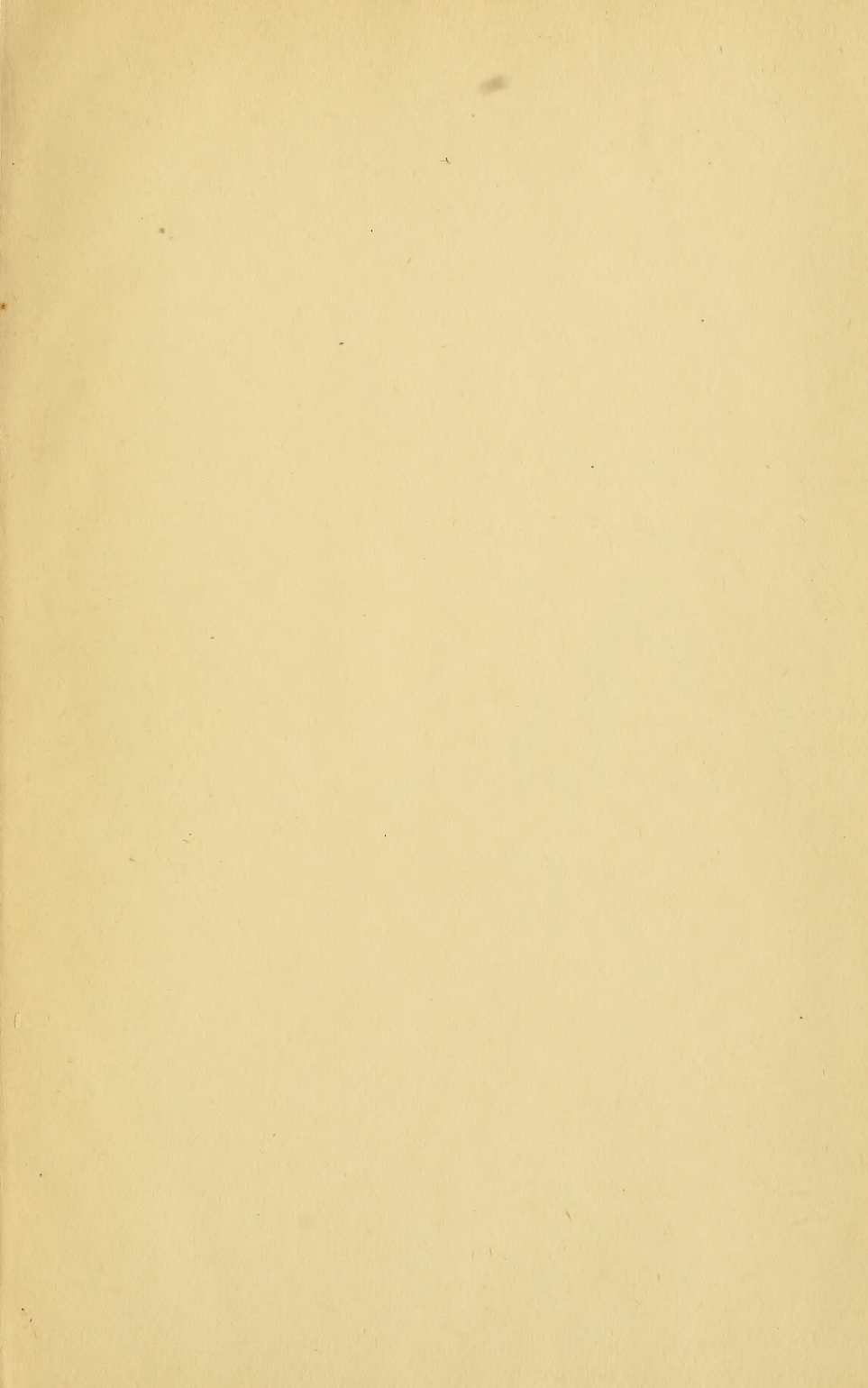








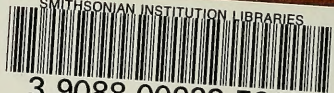








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